IMPACT OF PEER LEARNING

An investigation into the role and impact of Peer Learning in an online environment: a case study on students' learning experience

By

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any tertiary institution, and to my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the text of the thesis.

Songlak Sakulwichitsintu

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Abstract

This research investigates the role and impact of technology-supported peer learning activities in an online environment through a case study examining students' learning experience. The case study involved 196 students, 14 teaching staff and 3 technologies used within three academic units (one first year undergraduate unit, one third year undergraduate unit and one master level postgraduate unit) at the University of Tasmania over two years.

In research on peer learning there is evidence that a positive student learning experience is important for successful learning. But the concept of the student learning experience is still poorly defined. There is also evidence to highlight that in an online environment, the student learning experience involving peer learning activities has been negatively impacted by challenges related to several factors including: students' accountabilities when working with other students, and challenges related to students' communication on exchanging learning experiences.

These factors, including the lack of clear definition of the student learning experience pose further challenges to improve the development, implementation and evaluation of peer learning activities within the online environment. These challenges include the absence of guidelines on how best to develop and implement peer learning activities in an online environment; how to link these activities to select the right technology to support peer learning in online environment; and how to customize individual delivery and assessment to enhance student learning experience.

Previous research has already identified the influence of a range of factors on peer learning including: the attribute of individual student; the role and behaviour of teaching team; student understanding of the unit requirements; natural events and experiences of peer activities; supporting of social relationships; and the design, adoption and use of information technology. However, exploring their relationship and how they influence student learning experience is still limited. In this context, this research aims to:

(1) Investigate the role and usefulness of peer learning activities in an online environment for contributing to students learning experiences;

(2) Implement a set of technology-supported peer learning activities and evaluate their impact on students learning experiences in an online environment;

(3) Generate a framework for supporting online peer learning unit designs that optimise students learning experiences

The research methodology deployed in conducting this exploratory investigation adopted a research philosophy drawing on a subjective ontology and interpretivist epistemology. The research strategy involved a case study involving participants and technologies used in three educational units (one first year undergraduate unit, one third year undergraduate unit and one master level postgraduate unit) at the University of Tasmania over two years.

The research design utilised both qualitative and quantitative methods structured through a pre- and post- intervention approach over four phases supporting concurrent triangulation. The four phases were: a preliminary phase selecting and assessing units for the case study; a baseline phase involving data collection and analyses of existing unit delivery; a redesign phase involving development, implementation and evaluation phase targeting students learning experiences; and an outcome phase involving interpretation and discussion of the research findings. Across the first three phases data collection involved the use of both quantitative and qualitative techniques. Data analysis techniques included the use of social network analysis, descriptive statistics, factor analysis and thematic coding of the qualitative data from 3 focus groups and 14 semi-structured interviews. Following base-line analysis of two online units, re-design was conducted within the two online units and evaluation conducted within them.

Based on this research it is possible to provide a clearer definition of student learning experience in the context of technology-supported peer learning in an online environment as follows:

> *The processes that contribute to an individual student's acquisition of new knowledge and skills as well as an increased awareness, understanding of, and engagement with group work.*

The efficacy of these processes is related to an individual's personal motivation and perception of, and engagement in interaction and communication with other students as supported by teachers and technology in an online environment. To understand and investigate the diversity of the processes involved in student learning experience, it is useful to consider them across 7 inter-related dimensions. These 7 dimensions are accountability for collaborative works, sense of community, self-efficacy for reflection, group work contribution, competency of reflective practices, assistance for interaction, and communication convention.

The research has produced four key findings as follows:

(1) The nature and importance of the interdependence among the three peer learning attributes (interaction, communication, and motivation) on the learning experience of students. When students have their critical thinking presented and share their active ideas, other students (peers) are challenged and encouraged to use reflective practice without feeling direct pressure. Consequently, the peer interaction was increased as a result of both critical thinking and reflective practice, all of which help improve the learning experience of students. This finding shows that it is not the frequency of interaction but the perception of content quality exchanged is significant. The capacity of the individual for beginning, and reflecting on, peer communication is also significant for enhancing the learning experience of students.

(2) The identification of student-related factors and their influence on peer learning activities, the six student-related factors involved and identified as follows: intrinsic improvement, skill development, conversations, moral awareness, orientation to learning, and assessment driven. This key finding focuses on students' own accountability, skill development, and orientation attendance. The students who showed their own critical thinking would have the responsibility to work together. Also, they understood the importance of interactive feedback, which had an influence on any increase in their peers' reflective practice. The increase of understanding, perception, and performance of accountability for peer learning activities definitely affected the improvement of students' learning experience. This finding shows that targeting these factors during re-design can enhance peer learning activities by stimulating improved accountability, critical

reflection, appropriate orientation to learning and the improved expectations of students around skills development, learning outcomes, assessment and the use of technology. All these have been identified as contributing positively to students' learning experiences.

(3) The impact and role of the teaching team on peer learning activities, learning resources and learning environment. This finding suggests that re-designs that encourage students to actively participate in peer learning without the involvement of teachers require that the teaching team clearly explain the aims, assessments, and objectives of technology-supported peer learning activities. However, the teaching team must continue to anticipate that some students will still requires direct interaction with the teaching team. The student learning experience is greatly enhanced by the teaching team when resources, the learning environment and peer learning activities are communicated, structured and delivered in an integrated and holistic manner.

(4) Understanding the role of technology affordance and integration on peer learning activities. This finding suggests that the interaction between students on peer learning activities worked more effectively by using technologies that supported asynchronous communication, while the interaction of the teacher and student worked effectively by technologies that supported synchronous communication. For the learning experience of students, it is also apparent that message notifications are a useful way of stimulating the interaction even when using asynchronous technologies.

At the substantive level, this research contributes a detailed case study on the role and impact of technology-supported peer learning activities in an online environment. Specifically it identifies factors relating to peer learning attributes, the role of the teaching team and the role of technology and how these interact to impact on students learning experiences.

At the methodological level, this research deployed a pre- and post- intervention over four phases to support concurrent triangulation. This approach supported the investigation of the impact of a range of factors and their inter-relationships on students learning experiences from online peer learning.

At the theoretical level, this research has produced a framework of recommendations for peer learning of educational units being launched in online environments. This framework highlights how to enhance student learning experiences from their participation in technology-supported peer learning activities. The framework also illustrates how teaching staff can optimise orientation, teaching activities, learning activities, selection of appropriate technology tools, student assignments and group assignments and how these decisions link to the levels of interaction between students and between students and teachers.

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1.1 Introduction

This research investigates the role and impact of technology-supported peer learning activities in an online environment through a case study examining students' learning experiences. The case study involved 196 students, 14 teaching staff, and 3 technologies used within three educational units (one 1st year undergraduate, one 3rd year undergraduate and one postgraduate unit) at the University of Tasmania.

Research into peer learning provides evidence that a positive student learning experience is critical for successful learning. However as a concept, the student learning experience remains poorly defined. There is also evidence highlighting that in online environments the student learning experience involving peer learning activities is negatively impacted by challenges relating to a number of factors including: students accountability when working with other students; and, challenges related to the students' communication when exchanging learning experiences.

Combined, these factors and the lack of a clear definition of the student learning experience pose challenges to improving the development, implementation and evaluation of peer learning activities within online environments. Other challenges include the absence of guidelines on how best to develop and implement peer-learning activities in online environments; how to link these activities to appropriate technology choices to support peer learning online and how to iteratively refine delivery and assessment to optimise the student learning experience.

This research is placed at the intersection between distinct broader discourses as evidenced within Chapter 2: Literature Review (see figure 1.1).

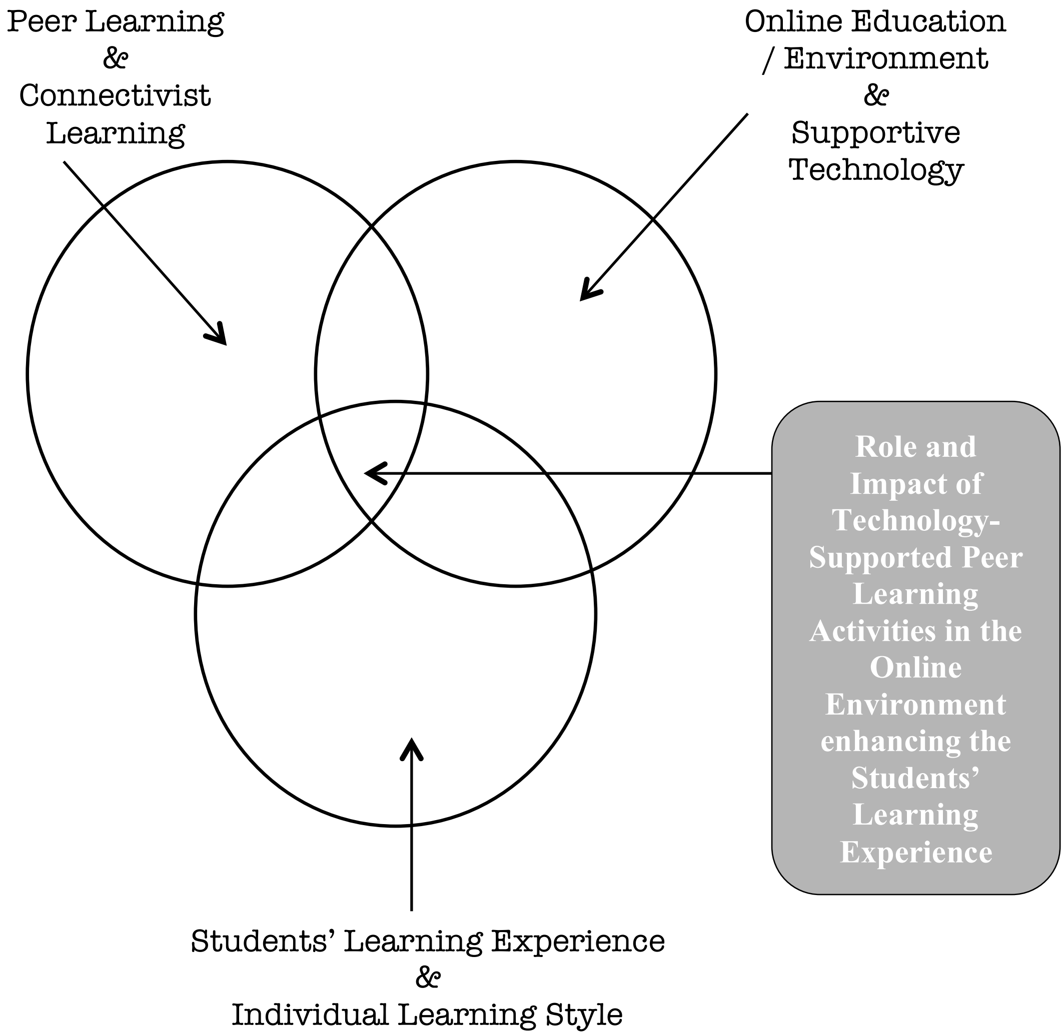


Figure 1.1: Research within greater research context

For consideration about enhancing the students' learning experience, there are 3 parts involved: 1) peer learning & connectivist learning, 2) online education/environment & supportive technology, and 3) students' learning experience & Individual learning style.

This chapter provides an overview of the background, method, and outcomes that have resulted from the research investigation. The primary research aims, questions, and objectives are specifically stated to justify the undertaking of the research.

1.2 Research Aims

In this context, this research aims to:

1. Investigate the role and usefulness of peer learning activities in an online environment for contributing to students learning experiences;
2. Implement a set of technology-supported peer learning activities and evaluate their impact on students learning experiences in an online environment; the set includes:
    - The use of asynchronous discussion tools to support higher levels of student-student and student-teacher interactions
    - The use of a face-to-face virtual room application as synchronous tools for student engagement and conversation
3. Generate a framework for supporting online peer learning unit designs that optimise student learning experiences

1.3 Research Questions and Research Objectives

This research is able to answer the following research questions along with their objectives.

Research question 1: What factors promote or hinder peer learning activities in an online environment?

> Objective 1: To determine the enabling elements of peer learning activities in online environment

> Objective 2: To determine the impact and position of the teacher on peer learning activities in online environment

Research question 2: How do technology-supported peer learning activities in an online environment impact on students' learning experiences?

> Objective 3: To determine what influences interactions when engaging in peer learning activities in online environment

> Objective 4: To determine what the affordances of technology are that contribute to the community development of peer learning activities in online environment

1.4 Research Justification

This research provides the following substantive, methodological and theoretical contributions to the body of existing knowledge.

At the substantive level, this research contributes a detailed case study on the role and impact of technology-supported peer learning activities in an online environment, together with a broad range of factors covering the peer learning attributes, the role of the teaching team and the role of technology. Also how they impact the student learning experience when students communicate or interact with each other. Frequency of communication and content exchange are also considered. For a student participating in technology-supported peer learning activities it is clear that, “learning experience” relies on students:

a. Accountability for collaborative works: Students must be conscious that interoperability is achieved depending on their own responsibilities for giving valued comments and opening up their mind, together with a willingness to help others with full support.

b. Sense of community: To work together or get involved in society or a community, students have to acknowledge their differences and believe in the ability and experience of the individual. With mutual understanding, students are able to create a good sense of community for the purpose of working together.

c. Self-efficacy for reflection: Students are able to extend their valued and constructive ideas and beliefs to complete tasks, they must be motivated and persuaded by somebody else including the fellow students and teachers. The skills of reflection are important for questioning and developing interactive writing.

d. Group work contribution: The degree of relationship between group members is an important part of maintaining group cohesion. Especially, when the group members have to interact periodically with each other through any available channels.

e. Competency of reflective practices: Questioning is a challenge to reflective practices when engaging and sharing expressive critical thinking.

f. Assistance for interaction: With high levels of concentration and attention, it is important to have intellectual curiosity for others’ opinion in order to stimulate and increase interaction.

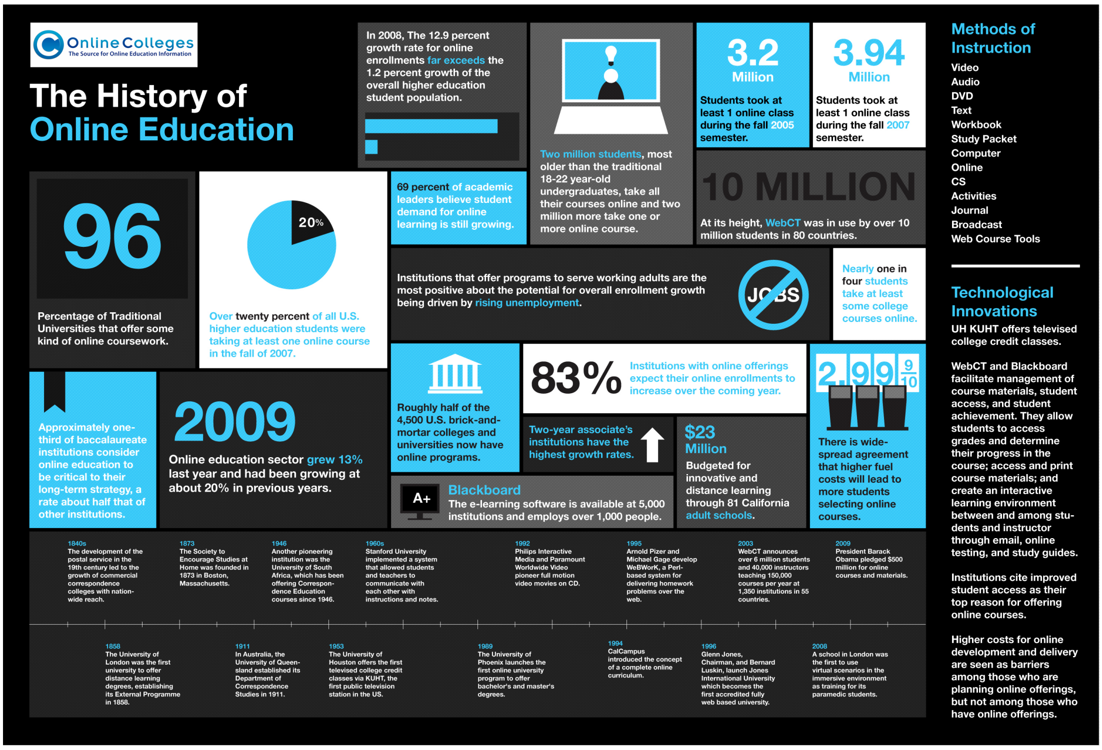
g. Communication convention: If students are relaxed, then they are more likely to contribute to any communication. Furthermore, mutual respect for other's opinions makes communication smoother and stimulates the collaborative participation through continuous communication.

At the methodological level, this research includes data collected from multiple quantitative and qualitative sources, then using various techniques of data analysis in an innovative approach to interrogate the data and address any emerging themes. This innovative mixed method approach is used for investigating the phenomenon of peer learning as it impacts the students' learning experience. By using this approach, it is also possible to determine a clearer picture of the role and impact of technology-supported peer learning activities in an online environment in order to enhance the students' learning experience.

At the theoretical level, this research will deliver a framework of recommendations for peer learning of educational units being launched in online environments with technology-supported peer learning activities to improve students' learning experiences (see figure 7.2). The framework illustrates how teaching staff provide orientation, teaching activities, learning activities, appropriate technology tools, individual assignments and group assignments based on levels of interaction between student-student and student-teacher. In addition, a structural model of exploratory factors will illustrate the relationship between significant factors impacting peer learning interactions in an online environment by highlighting underlying influence and causality in those interactions.

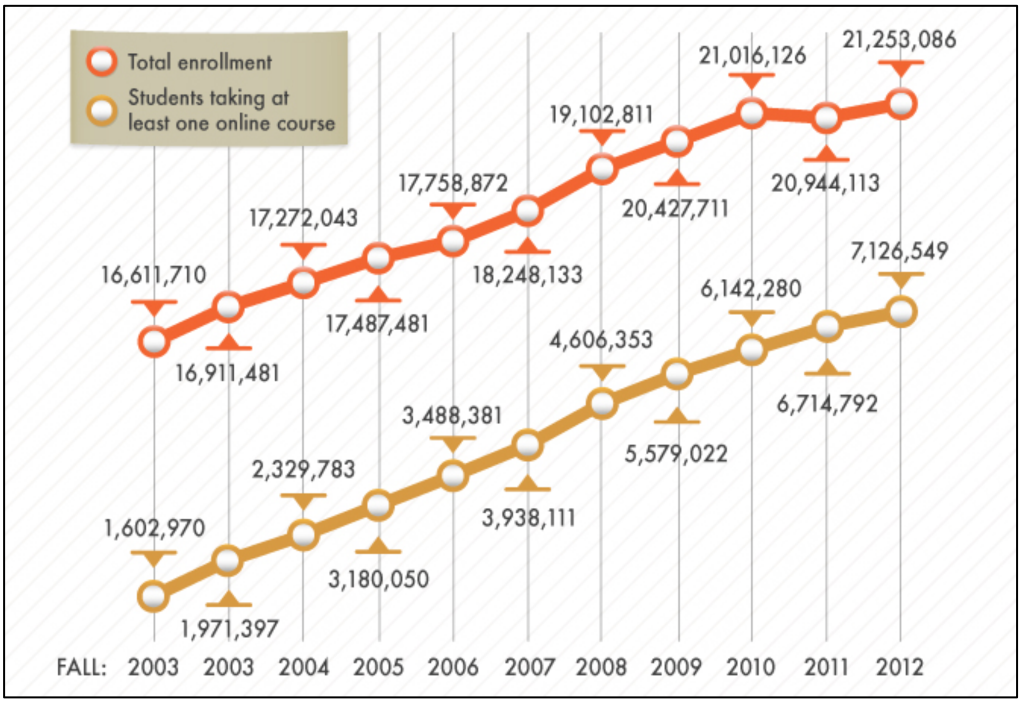
1.5 Project Rationale

The History of Online Education reports that 96% of universities deliver online courses and also that online education opportunities have increased (*Center for Online Education* 2015) (see figure 1.2). Online learning is a great support for higher education in an educational institution or university (Cater, Michel & Varela 2012; Chapman & Henderson 2010). Many U.S. or Australian student has enrolled in at least 1 online course over the courses of their academic career (*Vista College* 2015) (see figure 1.3). Online courses are popular in many universities for learning and extending current knowledge together with guidelines for teaching and learning (Carey et al. 2008; Herrington et al. 2001; Hew & Cheung 2014). Also, online courses are attractive for many registered students (Rodriguez 2012). Thus, online education significantly benefits individual learning because of availability, flexibility, affordability, and support; and particularly more economical for universities (Croft, Dalton & Grant 2010; Graves 2001).



Source: Center for Online Education (2015)

Figure 1.2: Growth in Online Education



Source: Vista College (2015)

Figure 1.3: Students' enrolment in online units

Although all research agrees that learning experience is important, learning experience tends not to be clearly defined and depends on the focus of the individual research. Moreover, the learning experience is described in slightly different ways depending on the perspective of the interrogation: teacher, unit content, technology, peer activities, and social relationships.

The literature shows that there are 3 key linked issues impacting students studying in an online environment. Firstly, students lack of accountability when working with others. As peer learning focuses on students learning with and from each other (Boud, Cohen & Sampson 1999) even in the era of web 2.0, students still need to learn together with peers, as it can be argued that it is an even more important part of the process of enhancing learning in online environments. As previously discussed, one major challenge in on-line learning environments is the relatively high drop-out rate (Croft, Dalton & Grant 2010) and peer learning has proven useful for reducing the isolation of online students in university or higher education programs. More recently, research has confirmed that students do not want to study alone, preferring to learn together through sharing learning experiences (Douglass, Smith & Smith 2013; Raymond et al. 2016). Critically, both Douglass, Smith and Smith (2013) and Raymond et al. (2016) highlight that:

- The success of students’ learning comes from the support of their peers.
- Working in groups can facilitate student learning.
- Students appreciate peer learning.

Peer learning is now widely promoted for students’ engagement in online environments (Bryson 2016; Yeh et al. 2016). Yeh et al. (2016) highlight that online peer learning delivers a number of benefits for students including increasing learning awareness, motivation to study and improve, and satisfaction with the learning experience. Bryson (2016) has provided evidence that students’ ongoing collaboration and participation influences both learning and teaching in higher education.

However, in any learning context, peer learning will only be productive if students meet their responsibilities in working with each other, such as giving appropriate feedback and posting and responding to peer questions (Prøitz 2010). Ensuring that students do productively engage in peer learning on-line and acquire positive learning experiences remains the key challenge in delivering effective on-line learning (Keller & Karau 2013).

Secondly, students may not easily share learning experiences with others. As different students have different learning potential and intelligence, some students need peer motivation or support in order to encourage them to exchange their own ideas and opinions (Russell et al. 2009), in order to ensure that the interactions between students who learn together have an impact on the success of online peer learning (Hew & Cheung 2014; Xu & Jaggars 2013). Xu and Jaggars (2013) highlight that students' learning potential and capabilities can be varied depending on their backgrounds and other factors. Hew and Cheung (2014) have provided evidence that encouragement and sympathy for each other is important for learning development. Peer learning supports students either when they assimilate lesson content or complete assignment tasks. The key challenge of successful online learning is to maintain a good relationship between students or student and teacher.

Lastly, the online environment affects the students' learning experience and ability to meet unit criteria or learning outcomes. As learning outcomes are expectations of what the student is anticipated to meet at the end of a unit. It is possible that peer learning activities can enhance students' learning experiences and their ability to better attain those learning outcomes if students meet their responsibilities by working with others and sharing their own learning experience with their peers (Vaughan 2007). Harris and Brown (2013) confirmed that both students and teachers realize that student accountability influences peer learning while students' interaction is better when each person understands the importance of peer learning. Both Sullivan, Marshall and Tangney (2015) and Hamid et al. (2015) critically highlight that peer learning activities are encouraged by technology. Sullivan, Marshall and Tangney (2015) have provided evidence that technology-based learning process enables learners to learn both the content of lesson, and the learning experience through peer support while Hamid et al. (2015) highlight that students' interaction is determined by their learning purposes.

This project will construct a comprehensive framework of guidelines for teachers and students in supporting and improving their engagement in an online environment. Teachers can then reflect on how the students' learning experience can be enhanced based on peer learning activities, teaching team activities, and supporting technology.

1.6 Chapter summary

This chapter provides the background information that underpins this research. The rationale of the research has been discussed together with the research aims, research questions, and research objectives. It has been identified that there are many challenges impacting peer learning activities within technology-supported online environments and that this research will greatly contribute to the current body of knowledge at the substantive, methodological and theoretical level.

1.7 Thesis Outline

The physical layout of this dissertation is described in detail below.

Chapter one outlines the background with the research aims, research questions, and research objectives of the study by providing justification and insight into this research project.

Chapter two reviews the literature underpinning this research. Chapter two has three sections. Section one examines technology supported online learning, focussing on the importance of technology support for students who study in online environment. Section two covers the overview of peer learning including concepts, aspects, and applying peer learning activities for supporting students' learning in an online environment; and the third section covers students' learning experience with pedagogy supported learning, individual learning style, and psychology supported learning with learning communities.

Chapter three details the methodological approach used for this research. A Case study of enrolled students and involved teaching staff of three educational units in the University of Tasmania were examined. The methodology consists of a mixed method design using both qualitative and quantitative methods with a concurrent triangulation approach over four phases: Preliminary phase; Baseline phase; Redesign phase; Outcome phase.

Data collection and data analysis involved 3 stages (3 semesters). Four data collection tools including discussion boards, online surveys, semi-structured interviews, and focus groups were undertaken.

Chapter four presents the quantitative data analysis results of the online survey and discussion board responses. The data collected was analysed using three different analysis techniques: social network analysis for discussion boards, and descriptive spreadsheet analysis and factor analysis for online survey analysis.

Chapter five presents the qualitative data analysis results from the semi-structured interview and focus group responses. The data collected was analysed using thematic coding by inductive and deductive coding.

Chapter six presents the interpretation of the data analysis presented in chapter four and chapter five, and then a discussion of these results from the perspective of the existing body of literature. The chapter further examines the results in relation to the intersection between technology-supported online learning, peer learning activities, and students' learning experience. Finally, discussion is presented in relation to the role of technology-supported peer learning activities in an online environment that might support the students' learning experience.

Chapter seven presents the findings that emerged from the research. Details of key findings obtained are discussed and then responded to in relation to the research questions. The findings present the role of peer learning activities together with a broad range of factors impacting peer learning attributes, the role and responsibilities of the teaching team and the affordances of technology-supported peer learning activities.

Chapter eight concludes the research by summarising the results presented by this research. It explicitly states the contributions that have been made and the limitations presented whilst the research was being undertaken. Finally, this chapter proposes further areas for consideration with thought to expanding and developing specific research themes further.

Chapter 2: Literature Review

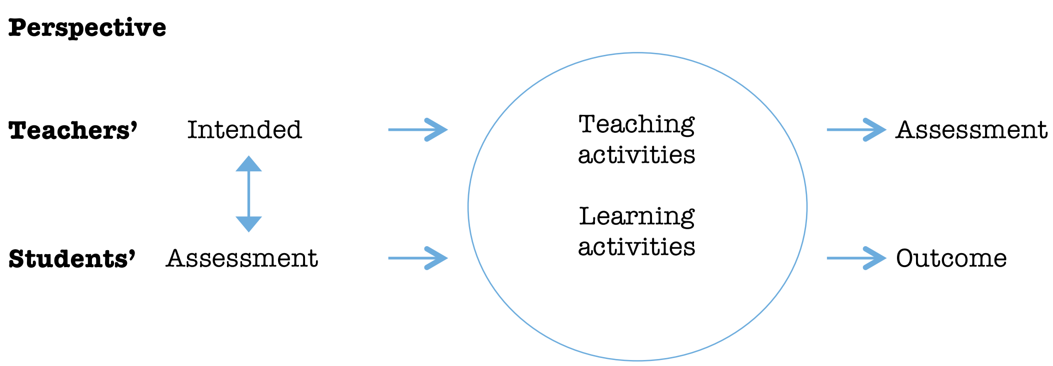
2.1 Introduction

This chapter provides a review of the main literary works that were sought and examined as part of the research. It includes 2.2) Technology supported online learning 2.3) Peer learning, and 2.4) Students' learning experience. These elements attempt to frame the comprehensive review of issues and approaches in an effort to optimise the student learning experience in an online environment for use in an educational institution context.

Educational Context

Tertiary or higher education maintains diverse educational levels from undergraduate to doctoral degree. The studying environment consists of both physical classroom learning space and the virtual online learning space. Also, the university and teacher prepare learning environment and technology tools according to learners' availability.

Tertiary education in any university generally considers suitable teaching and learning activities on the assessment or feedback on learning. According to the effects of assessment on learning, backward works positively by the encouragement of appropriate learning when the assessment is aligned to what students should be learning (see figure 2.1). Both the teaching activities of teachers and the learning activities of students are paralleled to achieve the same objective. For the preparation of assessment, students are learning the intended outcomes (Biggs & Tang 2011).



Source: Biggs and Tang (2011)

Figure 2.1: Teacher's and student's perspectives on assessment

Impacts on educational stakeholders

E-learning with internet and web technologies are adopted to support lifelong learning of knowledge communities at anytime and anywhere especially in higher education (Graves 2001). Furthermore, the technological innovation helps faculty and teachers not only by increasing learning opportunities contributed to by the university, but also results in learning productivity (Graves 2001; Hew & Cheung 2014).

Encouraging a successful IT system in a university can be done based on social constructivism as student-centred learning (Papastergiou 2007). Increasing the use of online education influences learners who have feelings of isolation based on the physical and temporary separation of teacher and student and between students (Croft, Dalton & Grant 2010). Moreover, distance learning has a high risk of drop-out with isolation being a significant contributing factor (Croft, Dalton & Grant 2010; Mark & Anthony 2007).

Challenges for delivering online courses relates to the broad diversity of learning styles in relation to online accessibility. Also, the possibility of a learner's isolation by way of lacking a cohort is a specific effect of the online education environment (Croft, Dalton & Grant 2010).

Belkin and Gray (1977) presented that alienation is a limitation of the individual and his/her connections with others, not a condition of the community. Alienation includes feelings of isolation and lonesomeness, disconnection from others, and a loss of consistent sense of self. Moreover, there are five elements of superiority of alienation including powerlessness, meaninglessness, normlessness, isolation, and self-estrangement.

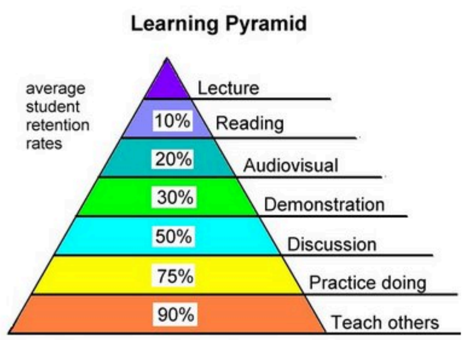
Furthermore, distance learning impacts not only students and their peers but also economic and social issues for academic institutes (Gammie, Gammie & Duncan 2002). Nowadays, universities and enterprises are in doubtful economic situations with high consideration on cost reduction (Bartley & Golek 2004). Online education becomes a profitable alternative (Bartley & Golek 2004), and it has advantages of scalable quality, convenient access, timely quality according to today's economic trend (Clarke & Hermens 2001).

The important obstacles to online learning are not influenced by current technologies, but by the pedagogical presumptions and comprehensions in the nature of their use (Bartley & Golek 2004). Advanced technologies are narrowly used only for inactive online tutorials and online books (Kilby 2001). However, the way to use technology influences the accomplishment of innovative and efficient ways of academic procedures online (Bartley & Golek 2004).

Online Education and Peer Learning

Boud, Cohen and Sampson (1999, p. 413) stated that peer learning mentions 'the use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher'. Specifically, each individual student has different learning potential and intelligence and aptitude (Carey et al. 2008; Daradoumis, Martínez-Monés & Xhafa 2006; Zhang, Carey & Te'eni 2007). The interesting point is that meaningful learning including building experiences will support learners to think accurately and apply knowledge to actual situations. That means meaningful learning with building experiences can improve learning outcomes (Daves & Roberts 2010).

The Learning Pyramid (figure 2.2) shows that the average student retention rates of 90% were the result of Teach Others. This indicated that Peer Learning has the highest retention rate (*National Training Laboratories Institute for Applied Behavioural Science* n.d.). Although this pyramid deals with offline learning, peer learning encourages students who are studying online as online has high retention rates (Abdol Latif, Sungsri & Bahroom 2009; Bryson 2016).



Source: National Training Laboratories Institute for Applied Behavioural Science (n.d.)

Figure 2.2: Learning Pyramid

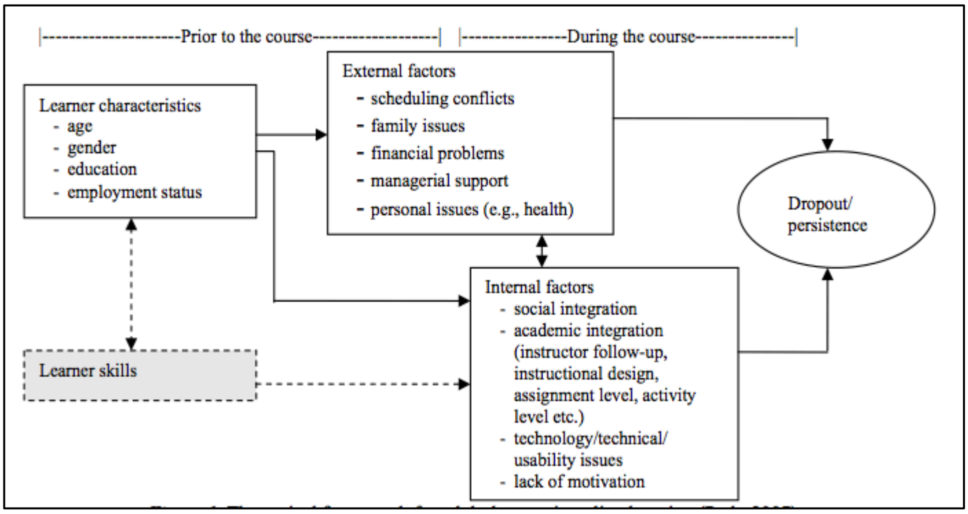
In higher education, there are limited budget for overloaded teaching staff (Boud, Cohen & Sampson 1999), and peer learning is initiated for teamwork skill development of graduates (Boud & Lee 2005) and increased participation for open learning groups (Ahn, Weng & Butler 2013).

One of the crucial reasons of attrition of open distance learning (ODL) organization is lonesomeness and separation sensation (Abdol Latif, Sungsri & Bahroom 2009). Online learners feel isolated (Palloff & Pratt 1999). In addition, isolation can affect an online learner's manner so online courses should be designed to meet the individual characteristics of learners (McInnerney & Roberts 2004). McInnerney and Roberts (2004) stated that for online learners, it is unavoidable to feel a sense of isolation, so teachers should improve online surrounding beforehand including preparation of prosperous online interaction manual.

Learners are discouraged by alienation and in an online community then they do not accomplish their study (Rovai & Wighting 2005). Rovai and Wighting (2005) presented that three alienation variables (social isolation, powerlessness, and normlessness) are connected with two classroom community variables (social community and learning community). Social community and learning community influenced online studying (Rovai & Wighting 2005), this is in accordance with Bronfenbrenner (1986) who claimed that alienation occurs because of a lack of feelings related to ownership.

Social isolation and normlessness are contrarily associated with learning communities through online learning (Rovai & Wighting 2005). Moreover, learners should discuss their pedagogical values, objectives, and requirements through online discussion together within a standard group setting (Rovai & Wighting 2005).

Park and Choi (2009) stated that dropout and persistent students differ in distinct personal attributes, awareness of family and institutional assistance, fulfilment and pertinence. Moreover, the persistence framework by Rovai (2003) and framework of adult dropout in online learning by Park (2007) concentrated on factors of dropout's determination including student skills, internal and external factors, and student characteristics (see figure 2.3). It can be found that motivation together with relevance and satisfaction are significant for dropout rates (Park & Choi 2009).



Source: Park and Choi (2009)

Figure 2.3: Framework of adult dropout in online learning based on Rovai's model

Distance learning benefits both learners and academic institutes by providing learning opportunities to learners regardless of location and society problems (Croft, Dalton & Grant 2010; Lake 1999). Liu, Magjuka and Lee (2006) claimed that distance learning are popular and delivered in higher education. Moreover, distance learning is referred as 'e-learning', 'on-line learning', and 'distance education' (Liu 2008)

Using technology for online courses supported learners who are able to work together (Macdonald 2003). The number of online courses in educational institutes including non-profit and profit organizations are increased (Carey et al. 2008). Currently, there are various communication approaches and tools, for instance, asynchronous discussion boards, webcasts, online workspaces, videoconferencing, peer-to-peer collaborative discussions, and blend face-to-face with online interactions (Carey et al. 2008; Treacy, Kleiman & Peterson 2002).

Learning community model of Online Professional Development (OPD) supports challenge of productive professional improvement for teachers and administrators of academic institutes. In the model, learners exchange ideas, comments and thinking including answer questions through asynchronous online discussion that are more reflective than synchronous face-to-face discussion (Treacy, Kleiman & Peterson 2002).

Importantly, there is evidence to show that university-delivered online education poses challenges to academic achievement (Razak & See 2010; Topping et al. 2013).

Another reason that the educational organization turns attention to peer online learning seriously is caused by the open opportunity for learners' studying and sharing knowledge or learning experience with each other. Moreover, meaningful learning including building experiences will support learners to think accurately and apply knowledge to actual situations for further improving learning outcomes (Daves & Roberts 2010).

The Impact of Peer Learning on Students' Learning Experience

To begin with, peer learning focuses on "the use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher" (Boud, Cohen & Sampson 1999, p. 413). Learners can discuss experiences, ideas and concepts with each other as they engage with their peers, reflect on what they are learning and improving their personal knowledge by being part of the peer discussion experience (Evans & Moore 2013; Topping & Ehly 2001).

In considering learning experiences from the perspective of students involved in peer learning, it is clear that there are a number of issues such as the lack of accountability in working with others for students who are studying in an online environment (Prøitz 2010) and that students may not easily exchange learning experiences within their cohort (Russell et al. 2009). These issues directly affect the learning experiences of the students and this directly impacts on their ability to meet the unit criteria or other defined learning outcomes of the unit (Vaughan 2007).

2.2 Technology supported online learning

Technology is an essential component used in education (Kemp et al. 2014) and it has been used for educational benefits including supporting the communication and interaction between student and teacher or students and their cohort (Schmid et al. 2014). Also, technology can increase the flexibility, facilitation and ease of online learning (Abrami et al. 2011). On the other hand, technology can negatively influence students' conviction, preference and learning experience (Kemp et al. 2014; Kukulska-Hulme 2012; Lai, Wang & Lei 2012).

Technology adoption is challenging and must be done carefully to ensure it can influence the improvement of learners' peer learning activities (Pozzi et al. 2007; Wang 2010), and creates meaningful learning by building and sharing learning experiences (Wang 2009, 2010). Teachers can support learner-centred approaches in online peer learning environments by selecting appropriate online technology (Abrami et al. 2011; Caballé, Juan & Xhafa 2008; Revere & Kovach 2011; Wang 2010).

As technology advances, any technology used to support an online learning environment must be set up and must function appropriately. This is to better enable students to engage effectively with their learning experiences and in particular, enhance students' interaction with peers as they learn (Revere & Kovach 2011).

Technology has been used in educational institutions for accommodating the needs of students, teachers and faculty members especially in higher education (Hannay & Fretwell 2011; Kassens-Noor 2012; Wankel 2009). Technology supported online learning includes Computer-Supported Collaborative Learning (CSCL), Group Decision Support Systems (GDSS), Technology Acceptance Model (TAM), Socio-Technical System (STS), Computer-Supported Communication and Collaboration Tools, Game-Based Learning, Mobile Learning, Social Technology and Social Networks, Massive Open Online Course (MOOC), and Social Learning Analytics (SLA) as follow

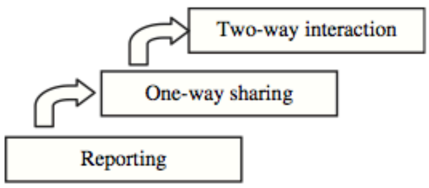
2.2.1 Computer-Supported Collaborative Learning (CSCL)

Computer-Supported Cooperative Work (CSCW) is advanced in collaborative learning manner named Computer-Supported Collaborative Learning (CSCL) (Wang 2009). Personalized annotation management system (PAMS) based on Technology Acceptance Model (TAM) is a web 2.0-based collaborative annotation system using for developing knowledge sharing in collaborative learning surroundings (Su et al. 2010). Su et al. (2010) also presented that the result of studying PAMS shows positive relationship between learning achievements and quantity of annotation.

In CSCL surroundings, a framework for tracking interactions between learners and tutors supports three important objectives: evaluation of quality of learning process, monitoring learners' performance, and assessment of individual learning performances (Pozzi et al. 2007). The five dimensions of this framework include participative, interactive, social, cognitive and meta-cognitive, and teaching. Teachers' tracking learners' collaborative learning activities make reasonable assessment for individual learner and can recognize problems suddenly (Pozzi et al. 2007; Wang 2010).

Collaboration by using online shared workspaces can sustain coordinating learners' collaborative attempt and watching learning process (Wang 2010). Furthermore, intimately monitoring learning processes can be useful for both teacher's identification of individual learner works, and learners' encouragement of active participation (Caballé, Juan & Xhafa 2008; Wang 2010).

Building groups by friendship and creating in meaningful learning task support, individual accountability and optimistic interdependence in CSCL (Wang 2009). Three levels of social collaboration using online shared workspaces (see figure 2.4) compose of reporting progress (no share resources or ideas), one-way information sharing (share resources and report progress), and two-way interaction (share resources; compromised meanings, ideas and feedbacks; with progress reports) (Wang 2010).



Source: Wang (2010)

Figure 2.4: Three levels of social collaboration using online shared workspaces

Computer-Supported Collaborative Learning (CSCL) in higher education is implemented and motivated toward learners who are unfamiliar with new system to involve learners' interaction and realize peers' thinking (Veldhuis-Diermanse 2002). Learners can use CSCL to conduct their tasks and strengthen their cognitive learning activities (Veldhuis-Diermanse 2002). In addition, social critical moderation can motivate learners to increase participation and collaboration for further public effort enhancement (Veldhuis-Diermanse 2002).

CSCL shows that technology is important for supporting the interaction of students who engage in learning together. Moreover, not only accountability but also motivation can encourage student participation. Although CSCL demonstrates that technology plays an important role in supporting student interaction, it cannot answer how technology may stimulate students to learn together.

2.2.2 Group Decision Support Systems (GDSS)

A GDSS consists of communication, computing, and decision support technology to solve a group's unstructured problems (DeSanctis & Gallupe 1987; Limayem, Banerjee & Ma 2006; Nour & Yen 1992) together with three crucial factors: group size, member proximity, and the task confronting the group (DeSanctis & Gallupe 1987). The objective of GDSS is to enhance the efficiency of decision groups by supporting interactive sharing and information usage among group participants including between groups and a computer (Huber 1984).

The consequence of GDSS on decision making procedures and outcomes depends on task structure significantly disjunctive and conjunctive tasks (Lam 1997). In addition, changing the patterns of group communication has a strong relationship with group decision quality (Lam 1997).

GDSS facilitative support mode may include user-driven (no facilitative support), chauffeur-driven (operational facilitative support), and facilitator-driven (task facilitative support) (Dickson, Partridge & Robinson 1993). Although supporting of group members effects to outcome, facilitation of GDSS should not be restrictive (Dickson, Partridge & Robinson 1993).

Decision guidance with cognitive feedback and feed forward at specific breakpoint advances faithfulness appropriation of GDSS, and whereby pointing to better decision outcomes and perceptions of decision process (Limayem, Banerjee & Ma 2006). The cooperation of technology support, communication mode, and incentive structure can influence group decision making (Barkhi, Jacob & Pirkul 2004).

According to GDSS, making decisions to solve problems is part of the process of stimulating learning. In addition, members need to support each other for completing the assignment or task by mutual intention. Although it demonstrates that technology plays an important role in supporting students' learning to complete the assigned task, it remains unclear what the factors influencing peer learning are.

2.2.3 Technology Acceptance Model (TAM)

Learning is the principal cause of personal and professional achievement focus on supporting learning manner and perfect learning environment. Using e-learning can recognize the learning enhancement via Web-based technologies (Petrova 2007). E-learning is used extensively in educational institute such as school or university and some learning development part of business firms.

Since the beginning of e-learning selection in every university is currently perceived tactical approach to encourage and support learning environment for further student accomplishment (Petrova & Sinclair 2008).

Technology Acceptance Model (TAM) was improved to evaluate how users manipulate and accept technology by theory of perceived usefulness and perceived ease of use describing user's attitude to system (Su et al. 2010). Lee (2010) stated that expectation-confirmation model (ECM), technology acceptance model (TAM), theory of planned behaviour (TPB) and flow theory influenced to learners continuous learning (see figure 2.5).

For ECM, the five hypothesis are (H1) users' satisfaction with e-learning is positively related to their continued e-learning usage intention, (H2) users' confirmation of expectations is positively related to their satisfaction with e-learning, (H3) users' perceived usefulness of e-learning is positively related to their satisfaction with e-learning, (H4) users' perceived usefulness of e-learning is positively related to their continued e-learning usage intention, and (H5) users' confirmation of expectations is positively related to their perceived usefulness of e-learning.

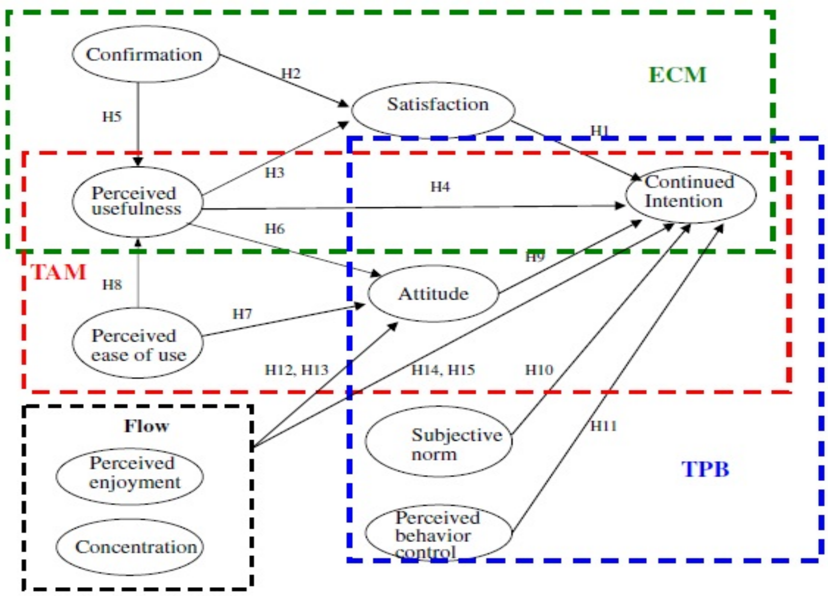
For TAM, both perceived usefulness and perceived ease of use are beliefs related to theory of reasoned action and may influence to user's attitude (Fishbein & Ajzen 1975). These 3 hypothesis of TAM are (H6) Perceived usefulness is positively related to behavioural attitude toward e-learning, (H7) Perceived ease of use is positively related to behavioural attitude toward e-learning, and (H8) Perceived ease of use is positively related to perceived usefulness of e-learning.

For TPB, there are 3 hypotheses which are (H9) Behavioural attitude toward e-learning is positively related to the continued intention to use e-learning, (H10) Subjective norm is positively related to the continued intention to use e-learning, and (H11) Perceived behavioural control is positively related to the continued intention to use e-learning.

For flow theory, users understand their activities and cannot remember any changes enclosing. The 4 hypotheses of flow theory are (H12) Perceived enjoyment is positively related to the attitude toward e-learning, (H13) Perceived enjoyment is positively related to the behavioural intention to use e-learning, (H14) Concentration is positively related to the behavioural attitude toward e-learning and (H15) Concentration is positively related to the behavioural intention to use e-learning.

Questionnaire survey, pilot test, sample plan and data collection are used for research methodology. Using questionnaire survey, two tested parts are choice measurement and question for participants (Lee 2010). Moreover, seven-point Likert scale uses for choice measurement. For pilot test, there are suitable sampling and evaluation of results using reliability coefficient and factor analysis. For sample plan and data collection, every element was tested with population controls (gender, age, studying levels) and website usage.

The result is described that satisfaction is most powerful predictor of users' continuance attention, followed by perceived usefulness, attitude, concentration, and perceived behavioural control as significant but weaker predictors (Lee 2010)



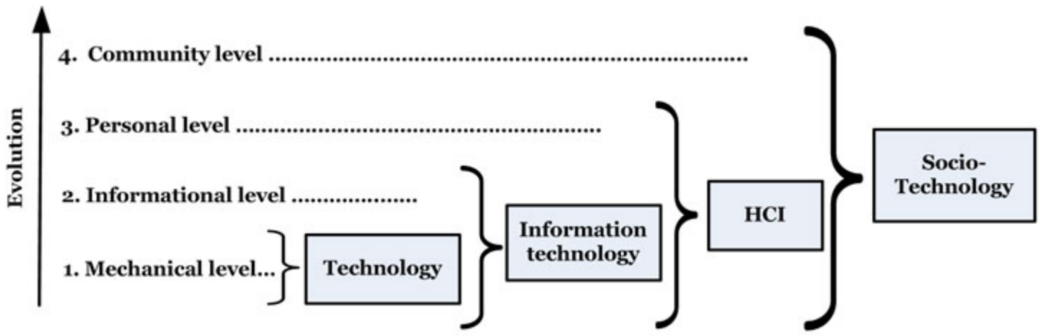
Source: Lee (2010)

Figure 2.5: Expectation-Confirmation Model (ECM), Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB) and Flow Theory

According to TAM, students who find technology useful and easy to use are likely to be able to engage in online peer learning successfully. However, TAM on its own provides limited insight into the most appropriate technology selections to achieve the most optimal result.

2.2.4 Socio-Technical System (STS)

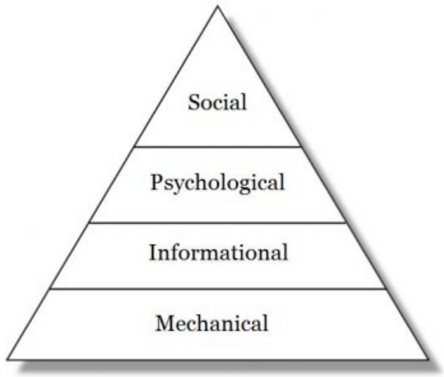
Fundamental to Socio-Technical System (STS) Design is common system theory (Bertalanffy 1968). The level of computing system (see figure 2.6) can be displayed with various levels that are 1) mechanical level: using technology (only hardware) as a tool that people build it, 2) informational level: use information technology including hardware and software to work together, 3) personal level: human computer interaction (HCI) conducts human needs for computing and HCI changes the information into meaning), and 4) community level: people create online community with hardware, software, personal, and community status (Whitworth & Ahmad 2013). STS is made according to personal and community requirements (Whitworth 2009).



Source: Whitworth and Ahmad (2013)

Figure 2.6: Computing applications and levels

In addition, computing applications and levels are implied and related to the computing requirements hierarchy (see figure 2.7). Mechanical, Informational, Psychological, and social needs are supported four previous computing levels respectively as well (Whitworth & Ahmad 2013). Moreover, higher level influences to lead successful computing. For instance, social communication requires a society to succeed. Lower levels should protect failure, but higher levels are important to success.



Source: Whitworth and Ahmad (2013)

Figure 2.7: The computing requirements hierarchy

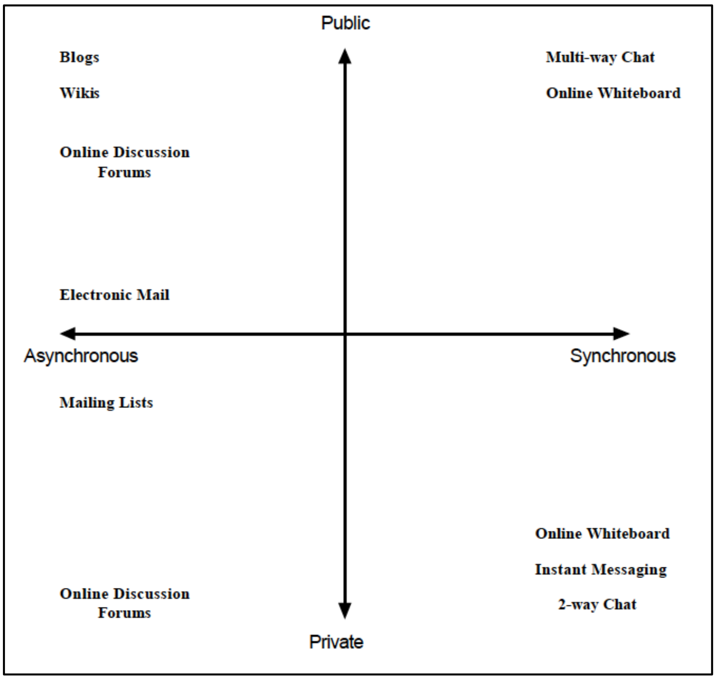
Knowledge is publicly created, communicated, and validated; and knowledge creation is either supported or forced by social interaction, for instance, collegial interaction affected teachers' professional development (Park et al. 2007).

As communication has many levels, STS focuses on both individual and community. Also, knowledge will be generated when communities can exchange information with each other. Although STS shows that learning together enables the sharing of ideas and knowledge with both individuals and groups, it is not clear how individuals or groups should behave during these interpersonal communications.

2.2.5 Computer-Supported Communication and Collaboration Tools

As discussed in section 2.2.1 on Computer-Supported Collaborative Learning (CSCL), the process of collaboration can be supported by working groups and facilitating communication (White et al. 2010). Moreover, small groups are formed to support sharing ideas and feedback together with performance encouragement (Raelin 2002).

Several computer-supported communication and collaboration tools are located in private-public axis and synchronous-asynchronous axis (see figure 2.8). It can be seen that instant messaging is available in synchronous and private dimensions (Hernández-Ramos 2004). Different technologies are implemented in organizations based on users' needs and chat as instant messaging is also used for quick response real time communication (Hearn, Foth & Gray 2009) and creating working groups (Chan, Ly & Meulemans 2012). Instant messaging (IM) is used for collaboration and supporting networks (Muller et al. 2003) and it enhanced students' interaction engagement, self reflection capabilities and critical thinking skills (Jin & Erben 2013). In addition, Blackboard Collaborate is one available synchronous academic tool that has a whiteboard, allow desktop sharing and recording, and can be used of engagement and communication during live sessions (Jones & Hansen 2014; Yeung 2013).



Source: Hernández-Ramos (2004)

Figure 2.8: Computer-supported communication and collaboration tools

Teachers are encouraged to use technologies in order to investigate attitudes towards technology and intend personal preference for reflection (Shoffner 2009). Technology can be used to support teachers to increase students' reflective learning with engagement in reflective tasks (Strampel & Oliver 2007).

Computer-Supported Communication and Collaboration tools are used for communication between individuals regardless of synchronous or asynchronous features. It also depends on convenience and the purpose of usage. Although CSCL shows that both synchronous and asynchronous communication modes are important for learning together, it is not possible to determine the extent to which each of the features is suitable for peer learning.

2.2.6 Game-Based Learning

The considerable concerns in playing games is gender differences, educational capability, self-respect and computer self-effectiveness (Paraskeva, Mysirlaki &

Papagianni 2010). Video game enslavement is youth's problem especially males and dependence is related to bad academic performance and offensive attitudes and manners (Hauge & Gentile 2003). Moreover, learners enjoy games in which they participate in the action as a role player and males tend to play games more than females (Paraskeva, Mysirlaki & Papagianni 2010).

It can be seen that academic games should be considered educational operation, self-appreciation, and computer self-capability (Paraskeva, Mysirlaki & Papagianni 2010). Effective Video game should consist of edutainment & academic games, motivation, story context, objectives and rules, and interactivity & multi-feeling cues (Dondlinger 2007). Learning theories for video games should include constructivism, constructionism, and cognitive procedures (Dondlinger 2007). Moreover, learning outcomes and gender preferences should be encouraged by design and improvement of academic game.

Gros (2007) claimed that digital games are user-centred to support challenges, communication, engagement and enhancement of problem solving procedures. Furthermore, commitment and motivation are important advantages of games using but academic aims may not be pleasing (Gros 2007). Gros (2007) also presented that using game will be achieve depend on staff or teacher support by their analysis and consideration. In addition, this approach can be time consuming and personal differences should be considered for successful learning.

Game computing can be an instrument for supporting productive geography studying and it also encourages learners' motivation (Tüzün et al. 2009). However, Tüzün et al. (2009) claimed that good document and problem awareness should be considered according to possible implementation problem such as software, hardware, and infrastructure issues. Malone (Ebner & Holzinger 2007) claimed that satisfied computer game should have three important attributes including challenge, imagination, and inquisitiveness.

Internal Force Master (IFM) online game required that players have to know the true solution for the purpose of producing a winner (Ebner & Holzinger 2007). Moreover, background, high mark and restricted time, easiness and clearness, and usability are the definite requirements for testing effective learning procedures and motivation measurement. Ebner and Holzinger (2007) presented that prosperous game-based learning depends on abundance of motivation. Also, user-focused design at the starting of project is necessary with regard to learners' knowledge existence. Game procedure was more sufficient and inspired than non-gaming procedure to advance learners' knowledge (Papastergiou 2009).

Personal learner characteristics should be considered with regard to game design and together with thoughtfulness of pedagogical value of games (Papastergiou 2009). Kiili (2005) claimed that experiential gaming model concerned educational theory, flow theory, and game design by concentrating on sudden feedback, explicit objectives and challenges of players that are related to his/her skill level (see figure 2.9).

Source: Kiili (2005)

Figure 2.9: Experiential gaming model

The major objective of the model is to connect playing a game with empirical studying for the purpose of simplifying flow experience (Kiili 2005). In addition, both cognitive and behavioural actions are significant for studying. Nevertheless, social communication is not involved in this model. Moreover, increasing the skill of players and becoming more difficult game should be happened simultaneously for keeping player in game flow (Kiili 2005).

Game playing requires experience and personal skills for understanding and learning. It needs to be stimulated or motivated by self-interest. Those who are good at playing games should have good computer skills. Although game-based learning has also shown that skills have an impact on learning, it is not possible to know exactly how each skill influences learning or how skills interact in the learning process.

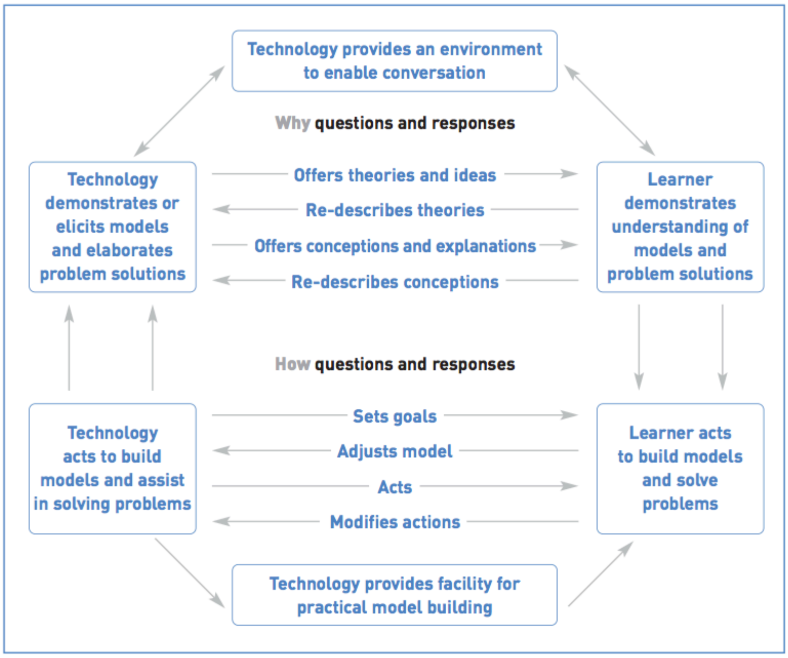
2.2.7 Mobile Learning

Conceptual framework of mobile learning (M-learning) facilitates the design of studying-centred educational surroundings that best utilises mobile and wireless appliances including four important parts that are improving learners' experience with learners' involvement, recognizing learning circumstance, challenging students, and practice preparation (Cobcroft et al. 2006). M-learning is productive to enlarging learning adjustability by changing studying more particularized and student-centred movement (Cobcroft et al. 2006).

Notwithstanding, Cobcroft et al. (2006) claimed that the framework should be determining modern choices, containing m-learning's senseless possibilities, and commitment with circulated learning networks and distant communities. Critical mass of using mobile and wireless technologies that force organizations to select proficient m-learning methods and plans should be definitely considered (Cobcroft et al. 2006).

Naismith et al. (2004) stated that advancement of mobile phone technology is starting to present capability of prosperous multimedia experiences and location-definite resources. The main issues of studying with mobile technologies consist of context, mobility, studying over time, friendliness, and possession (Naismith et al. 2004). Moreover, mobile computer-supported collaborative learning (MCSCL) is using mobile technologies to encourage, facilitate, and improve interactions and collaboration between learners (Naismith et al. 2004).

Naismith et al. (2004) also presented that using technology can support conversational learning including surrounding preparation, for instance, and this is not only for individual learners but also for leaners' groups as well. Figure 2.10, is shown that using technology can support conversational learning.



Source: Naismith et al. (2004)

Figure 2.10: Using technology to support conversational learning

To consolidate major learning activities based on pedagogy theories for mobile using may be suitable for supporting learners especially an actual student-centred method (Naismith et al. 2004). The theories consist of behaviourist learning, constructivist learning, situated learning, collaborative learning, informal and lifelong learning, and learning and teaching support (see table 2.1). Different activities in the use of mobile technology have different supporting theories, for example, rehearsal and reaction activities are supported by theory of behaviourist learning; assist activities in administrative responsibilities are supported by theory of learning and teaching support.

Table 2.1: An activity-based approach to consider learning with mobile technologies

Theory topics	Key Theorists	Activities
Behaviourist learning	Skinner, Pavlov	• rehearsal and reaction • classroom reaction systems
Constructivist learning	Piaget, Bruner, Papert	• associated simulations
Situated learning	Lave, Brown	• problem & case-based learning • context mindfulness
Collaborative learning	Vygotsky	• mobile computer-supported collaborative learning (MCSCL)
Informal and lifelong learning	Eraut	• sustaining reasoned and unexpected learning scenes
Learning and teaching support	n/a	• individual organization • assist in administrative responsibilities (e.g. appearance)

Source: Naismith et al. (2004)

Motiwalla (2007) claimed that a mobile learning framework comprises of mobile connectivity and e-learning for m-learning applications and it employs pedagogical methods including constructive studying and conversational theories. Furthermore, m-learning and e-learning use same pedagogy but they have different tools, see table 2.2.

Motiwalla (2007) stated that learners may confuse doubtful overloading of information and interaction, and also important issue of m-learning is user-interface, for instance, interactive voice recognition (IVR) development for converting voice to text before forwarding to discussion board.

Table 2.2: Comparison between e-learning and m-learning

Pedagogy	e-learning category	m-learning category
Course site	HTML website	WML website
Class materials	Online messages, URLs and presentation slides	URL links to course website
Class experience	Whiteboards, group journeying, virtual demos, chat space, discussion boards, and email	SMS, notification, discussion boards, course timetable
Assignments/projects	Email attachment or announcing to web forms	Immediate messaging for project cooperation
Student evaluation	Online examination, chat space/discussion board involvement	Online examination, chat space/discussion board involvement

Source: Motiwalla (2007)

Sharples, Taylor and Vavoula (2005) claimed that there are various projects of mobile learning including MOBIlearn, Caerus, Kleos, and Interactive Logbook. Theory of mobile learning is examined against criteria that 1) value differences from present theories of classroom, place of work, or lifelong learning 2) consider mobility of learners 3) include formal and informal studying 4) suppose learning as constructive and social procedure and 5) analyse learning as individual and located activity accommodated by technology (Sharples, Taylor & Vavoula 2005).

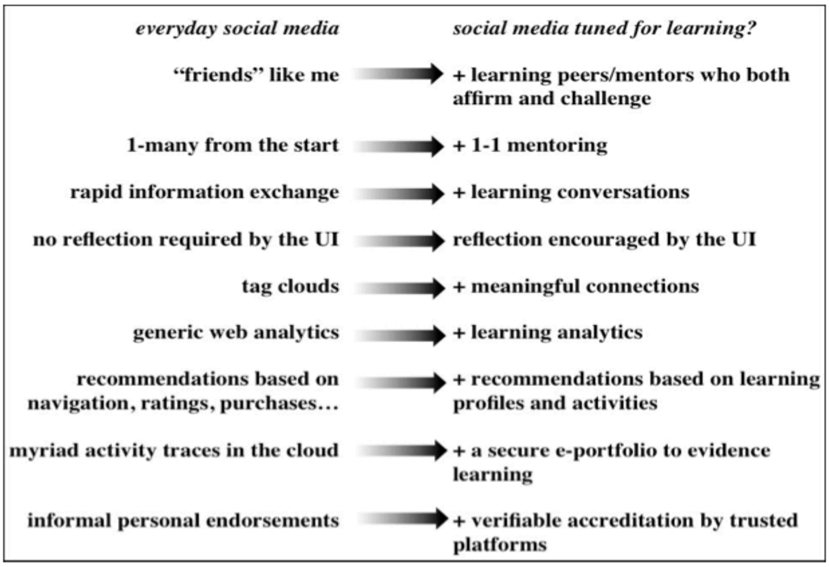
In addition, Sharples, Taylor and Vavoula (2005) presented that framework for analysing technology-mediated mobile learning has two interactive viewpoints including technology and learning. On the one hand, learning is harmonized by knowledge and technology as tools for fruitful queries, in jointly encouraging and energetically changing connection (Sharples, Taylor & Vavoula 2005). On the other hand, technology of human computer interaction is negotiated according to human viewpoint of social community (Sharples, Taylor & Vavoula 2005).

Yamaguchi (2005, cited in Chinnery 2006, p. 9) claimed that ‘A computer is better than a mobile phone for handling various types of information such as visual, sound, and textual information, but mobile phone is superior to a computer in portability’. Mobile Assisted Language Learning (MALL) has capability to increase social incorporation in language studying with shorten screen areas, controlled audio-visual quality, essential keyboarding, and one-finger data input, and restricted power (Chinnery 2006). Whereas, significant shortcomings including connection issues, nonverbal interaction, restricted word size, lack of cultural circumstance, and controlled social communication should be definitely considered (Chinnery 2006).

Mobile learning allows one to learn anywhere and any time. It also facilitates communication between students and with the teacher. However, mobile devices may not be as convenient as a notebook or computer to type long messages due to the small screen and other factors. Although mobile learning has shown that this technology has great potential as a tool for learning, it is not clear how learning together more optimally supported by using different types of mobile technologies.

2.2.8 Social Technology and Social Network

Education improvement and experience of both learner and teacher are influenced by social networking (Rahman & Dron 2012). Attributes of social learning consists of reasoning & consideration, communication & collaboration, experience & interactivity and evidence & verification (Shum & Ferguson 2011). Online social learning occurs when humans are able to pay attention to learning purposes, solving learning problems, and increasing for understanding learning communications (Shum & Ferguson 2012). Figure 2.11 shows the design space of social media learning: colleagues can change to be learning peers and coaches, informal approvals are improved into testable confirmation, and information discussions change to be learning communication (Shum & Ferguson 2012).



Source: Shum and Ferguson (2012)

Figure 2.11: Design space of social media learning

Learner-focused social media via online web can improve learners' recognition (DeAndrea et al. 2012). He also agrees that effective self-belief influences learners' mindfulness and partner's friendly help with information sharing are supported in learning network. Free social media such as Facebook is utilized for increasing learners' social relationship (DeAndrea et al. 2012). Belief of social networking may be related with less confident leaners' consequence (Lackaff 2009).

Cormier and Stewart (2010) claimed that social media are built for communities and participation. These media also are useful for supporting educational people especially teachers and students to have active works. Moreover, networking of commitment is more important than used technologies. Using of collaborative web tools including blog, wikis, and social network together can enhance potential online communication (Hastings 2009). Successful online relationships depend on whether social media services can be supported according to users' requirements (Hall 2011).

According to studying Networked Learning / Computer-Supported Collaborative Learning (NL/CSCL), Social Network Analysis (SNA) are used to analyse available data of WebCT log including participation patterns, collaboration, knowledge creation, and process evolution over time (Laat et al. 2007). Electronic learning community for students' interaction in e-learning is provided as social constructivist method for teaching and studying (Keppell et al. 2006; Macdonald 2004).

Social technology including social networking is capable of encouraging teaching and learning (Kukulska-Hulme 2012). Social network is referred as "The set of relationships, personal interactions, and connections among participants who have personal reasons to connect" (Wenger, Trayner & de Laat 2011b). Online learning is creating a network between students (Laat et al. 2007) and participation in community of practice or social network activities can create the value of learning (Wenger, Trayner & de Laat 2011b).

Social Network approach is used to determine the peer relationships (Kellogg, Booth & Oliver 2014; Sentse et al. 2014). Sociographs can represent network changes of study partnership over time (Grunspan, Wiggins & Goodreau 2014).

The network of student interaction with exchanged messages in discussion forum of online courses can be demonstrated by social network analysis (Carceller, Dawson & Lockyer 2015; Rabbany et al. 2014; Rabbany, Takaffoli & Zaïane 2011). Online discussion forum can support students' opportunity for interaction and create peer relationships (Carceller, Dawson & Lockyer 2015). Moreover, the patterns of peer interaction are an attribute of social networks in the online environment (Aviv, Erlich & Ravid 2007; Jones, Ferreday & Hodgson 2008).

Learning is using social networks as a tool to understand student relationships. Moreover, social networks create the usefulness of the learning community. Although social networks show that learning networks are very important for learning together, the ideal position or role of each student is written, as is the ideal position or role of the involved teacher.

2.2.9 Massive Open Online Course (MOOC)

Massive Open Online Courses (MOOC's) are knowledge creation in the digital society and available online with public enrolment, participated courses, and unrestricted consequence. Massive Open Online Courses (MOOCs) compose of social connection, usable online courses, and accommodated by subject matter experts. Learners can be knowledge builders and shoppers; and they manage their connection by themselves depend on their own objectives, interests, and previous capability and knowledge (McAuley et al. 2010).

MOOC is grounded on the creation of relationships, cooperation, and human discussion; the creation of learners' society, and the utilization of information moving on networks (Kop, Fournier & Mak 2011). Kop's learning model on public networked learning describes that not only learners' shared experience but also learners' serious participation should be considered for productive social learning (Kop 2010; Kop, Fournier & Mak 2011).

New functions of teachers consist of curator, learner, serviceman, helper, tutor, teacher, and partner (Kop, Fournier & Mak 2011). MOOC learning model is definitely concerned with sufficient equivalence of honesty and restriction when studying online courses via social networks (Kop, Fournier & Mak 2011).

MOOC is one of innovative methods using for guidance and learning with crossed cooperation (Baker, Bujak & DeMillo 2012). Some disagree terrible honesty of learners' experience and communication, while others trust that learners can conduct learning by themselves (Baker, Bujak & DeMillo 2012). McAuley et al. (2010) claimed that MOOC pattern is influenced by personal capability along with efficiency of digital and social media.

McAuley et al. (2010) also presented that there is no boundary between learners and teachers by using MOOCs. Especially, it can be seen that lifelong learning and cooperative relationship in higher studying can be increasingly by using MOOCs via digital environment (McAuley et al. 2010).

MOOC's by George Siemens and Stephen Downes have been introduced as "connectivist-MOOCs (c-MOOCs)" since 2008 and their special characteristics are connectivism including autonomy, diversity, openness, and interactivity. The example of c-MOOCs are CCK08 (2008) - Connectivism and Connective Knowledge, PLENK2010 (2010) - Personal Learning Environments and Networks and Knowledge, MobiMOOC (2011) - Mobile learning, EduMOOC (2011) - Online learning for today and tomorrow, Change11 (2011/12) - Education, Learning and Technology, DS106 (2011/12) - Digital Storytelling and LAK12 (2012) - Learning Analytics (Rodriguez 2012).

The attributes of c-MOOCs are social network linking, accepted expert accommodation, and central of available online courses (McAuley et al. 2010).

Distinct MOOC models will have dissimilar perspectives of knowledge and learning (Rodriguez 2012). c-MOOCs are related with learning connectivism whilst AI-Stanford courses rely on hub-spoke model (central knowledge and learners as knowledge copiers). "Connectivism and Connective Knowledge (CCK08)" is one instance of distributed Constructivism MOOCs and it was free for connected learners of the globe (Fini 2009).

Fini (2009) presented that Connectivism and Connective Knowledge (CCK08) course is a MOOC and it examines learners' opinion close to network technology and device for studying. Casual learners are interested CCK08 because of unrestricted studying. Participators' tool selection depends on their ICT capability, language problem and available time (Fini 2009). Rodriguez (2012) claimed that AI-Stanford course named Introduction to Artificial Intelligence (CS221) by Sebastian Thrun and Peter Norvig was distributed as massive open online course in 2011. It was accessed by a lot of students in the world and at no expense. "Udacity" (from audacity and university) was developed for improving CS221 in KnowLabs (for-profit firm).

Anderson and Dron (2010) presented that AI-Stanford like courses concentrate on cognitive behaviourism and the c-MOOCs focus on connectivism. Rodriguez (2012) stated that c-MOOCs are available for everyone who wants free learning and more understanding but AI-Stanford-like courses are prepared for someone who have no technical knowledge.

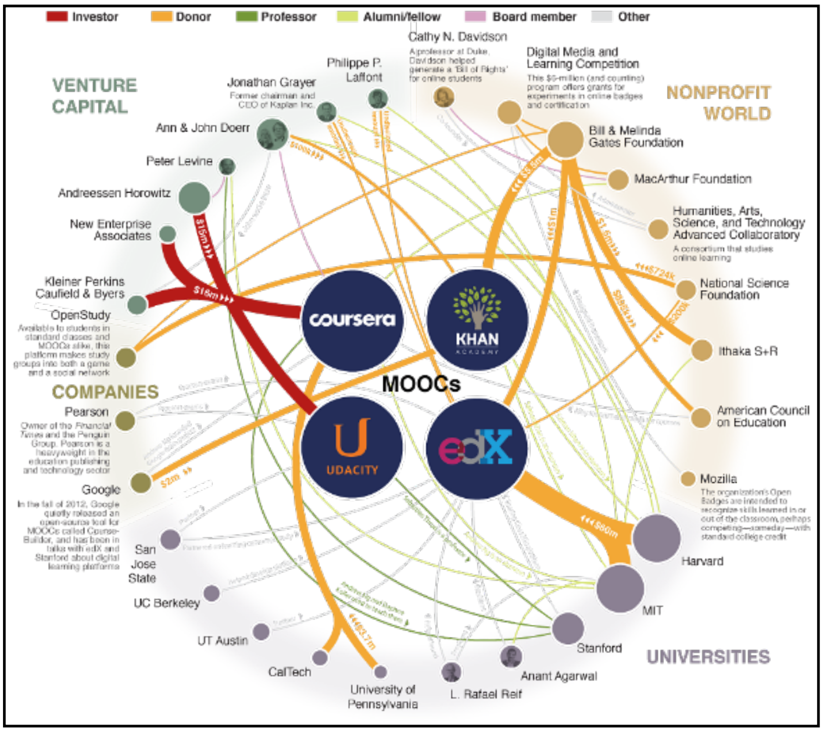
Bangladeshi American named Salmon Khan is the creator of shared video courses via non-profit Khan Academy. American education should encourage students to search beneficial knowledge by themselves; currently, public learning can be as social equality with supportive information technology. Learners acting as colleagues can assist together for finding solution (Gillespie 2013).

Moreover, Khan Academy is a good example of continuous and productive education which consists of scheming and responding. Khan began to produce video of math subject for his cousins and he helped all discomfort education (Ani 2013).

Teachers should understand their significant lessons and teaching methods for students (Ani 2013). Thompson (2011) claimed that some teachers agree with learning improvement via Khan Academy's studying; but some disagree about successful problem solving by video courses. Since 2010, Google and Bill Gates have supported funding to Khan Academy. Both Khan and Bill Gates perceived that it's difficult to build automated writing education and learner may help each other with this issue by discussion and communication (Thompson 2011).

David Cormier's MOOC is the cause of integrated open course concept and LMSs. MOOCS on the whole have no prerequisites, no payment, no predetermined attendance and no accreditation. Massive open artificial intelligence (AI) subject was developed by Stanford faculty Sebastian Thrun who has organized "Udacity" (profit firm). "Coursera" and "MITx" are developed by Stanford and MIT respectively. It can be seen that Stanford courses are encouraged by "Khan Academy" 's closed teacher style (Martin 2012).

MOOCs is utilized for valuable classroom (Martin 2012). Mahraj (2012) presented that MOOCs patterns of Udacity, Coursera, and edX are distinct from Connectivism MOOCs of Siemens and Downes. Mahraj (2012) also claimed that Siemens's MOOCs are the improvement of ontology whereas Udacity & Coursera's MOOCs are knowledge improvement. For more understanding about different MOOC players, see Figure 2.12.



Source: The Chronicle of Higher Education (2013)

Figure 2.12: Major Players in the MOOC Universe

Kop and Hill (2008) stated that Connectivism is an important theory for intelligent learning by way of learners' relationship and knowledge exchange in shared learning society. The structure of learning is adjusted to four parts that are objectivism (behaviourism), pragmatism (cognitivism), interpretivism (constructivism) and distributed knowledge (connectivism as learning theory) (Kop & Hill 2008). Connectivism MOOCs by Kop, Fournier and Mak (2011) presented that MOOCs cover information literacy including information assembling, resources administration, learners' learning processes, and effective networking (Mahraj 2012).

Knowledge stands in network relationship, not in private; learning is accepted in involved networks (Kop & Hill 2008). Knowledge is not studying or learning; and connectivism (as connected process) is encouraged for creating and conducting understanding with strong thinking (Kop & Hill 2008). General view of connective knowledge including knowledge type, clarification, appearance, physicality, prominence and implication, associationism, distribution, shared meaning, institution, social knowledge, law, public knowledge, knowing, and network (Downes 2005).

Connective knowledge is as knowledge of clarified and created connection between learners. Connection between learners should appear informal. And learner will be knower when he/she has experience by interpretation. To understand the meaning of learners' communication depends on their social knowledge translation via free knowing networks (Downes 2005).

At back of e-learning and personal learning surroundings, knowledge learning (with "connectivism" theory) is shared from experience and collaboration via knowing network society. "Cognitivism" is conventional theory and react to "behaviourism". Communication is as knowledge affirmation between sender and receiver. The concept of Personal Learning Environment (PLE) describes learners both use and deliver knowledge together (Downes 2006).

Anderson and Dron (2010) claimed that excellent quality of distance education utilizes three reproductions of cognitive-behaviourist, social-constructivist and connectivist as influenced by subject matter, circumstance and learning anticipation. Building connectivism is made on hypothesis of constructivist learning pattern focus on learners and associated knowledge including both outside groups & networks and learners' preferences (Anderson & Dron 2010).

Learning network is like a short trail between nodes; and information flows from one node to others which can be from internal and external connections. Stable free connection is affected by changing of intimate level whilst central connection is dominated by degree of immediate communication, fastest access, and control of information flow. The information flow happens all over network with two basic operations that are answering and conservation. Meaning is built when learners can answer by themselves (= answering); and new own knowledge is conserved and shared out in network (= conservation) (Seimens 2005).

MOOC can support continuous and effective learning through interpersonal relationships. Consequently, online students are encouraged to study and exchange learning experiences with each other. Although MOOC has shown that students can learn together through interaction, it is not clear how to engage students' online learning.

2.2.10 Social Learning Analytics (SLA)

As discussed in section 2.2.8 about Social Technology and Social Network, learning is a procedure completed by individuals and teams in social networks. Knowledge or skill comes from learning; and capability is shown according to learners' interpretation. Building a prosperous conduction to learning consists of four general varieties that are learning capabilities, learning individuality, learning narrative, and learning relationships. The emphasis on continuousness, determination and expansion policy in individual learning are implemented by four rules of individual studying engagement, community studying engagement, honour for others' studying, and honour for truthfulness (Crick, Broadfoot & Claxton 2004).

The Effective Lifelong Learning Inventory (ELLI) evaluation tool identifies proportions of learning displaying optimistic learning relationships are considered personal studying, others studying, society relationships with a divergence point of dependence and individualism. ELLI focus on student-centred that means understanding learners' aspects with their abilities, encouragement, and qualified communication comprehend the beginning point for teaching instead of more typical lessons (Crick, Broadfoot & Claxton 2004).

'Analytics is the process of developing actionable insights through problem definition and the application of statistical models and analysis against existing and/or simulated future data' (Cooper 2012). In order to use analytics in higher education, IT and organizational chiefs need to understand not only analytics but also changes in standard, instrumental procedures, institutes, rules, and organizational culture (Campbell, DeBlois & Oblinger 2007).

Higher education has lately commenced to determine the way to use analytics to gain more understanding on learning procedures such as EDUCASE (non-profit association to advancing higher education) or NGLC (organization for Next Generation Learning Challenges) are concentrating on academic society by making learning interaction model for enormous collected data. MOOCs happen in network of circulated teaching and studying and online social resources are used over different sites tracking by analytics model (Siemens & Long 2011).

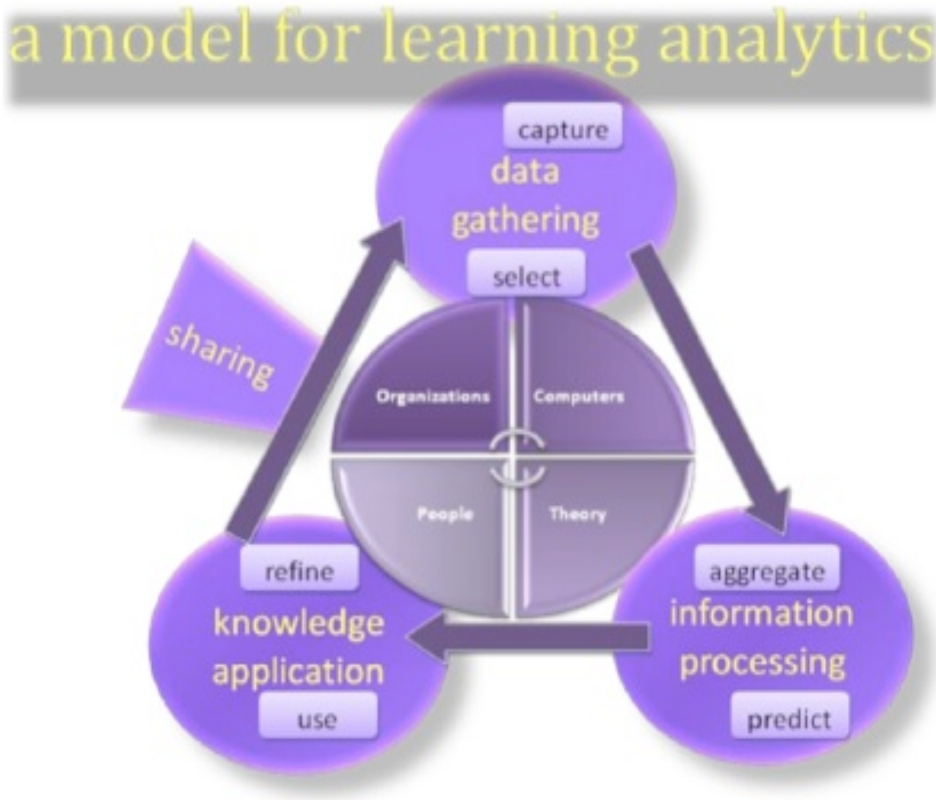
The First International Conference on Learning Analytics & Knowledge determined 'Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs'. Learning Analytics (LA) are used by educational people focus on connection of learning and information technology especially learners' improvement (Shum & Ferguson 2011).

Learning analytics has a distinctive path between pedagogy and analytics and it can be viewed on data gathering (possible vast data), data analysis (including qualitative and quantitative methods), learner studying (individual and/or partner level), educational people (teachers, students, institutes level), and intervention (all related participating levels) (van Harmelen & Workman 2012). The chart of professional analytics is displayed as a percentage of respondents reporting main advantages of analytics such as understanding student demographics and behaviours, optimizing use of resources, and helping students learn more effectively (van Harmelen & Workman 2012).

Learning Analytics illustrates the relevance of large data and analytics in studying. Moreover, it can be strongly trusted in honesty of procedures, phases, and technologies; modules combination; and decreasing of unavoidable portions (Siemens et al. 2011). Learning analytics definitely focuses on learning processes including analysis of connection between learner, content, organization and teacher (Siemens & Long 2011). Learning analytics can comprehend mess of higher education. For instance, students get useful accomplishment information related to their colleagues, or their aims' movement especially the development of quality and value of their experience (Siemens & Long 2011).

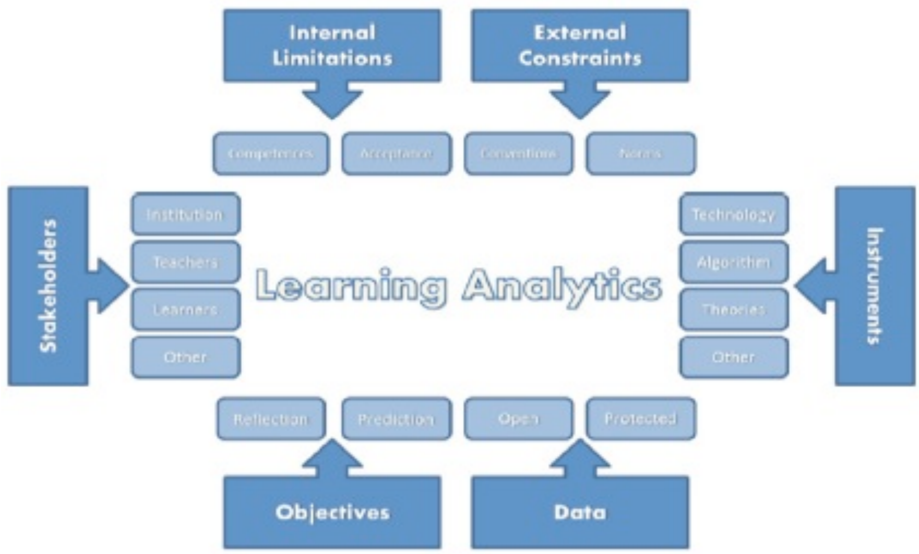
The Learning Analytics purpose as capability to be used by academic people to enhance learners' successful studying and to clarify beneficial services for learners based on old and new learners' information. Learning analytics covers the development of teaching and learning for private students and teachers, and the combination of procedures and instruments for teaching and learning. A model of learning analytics for continuous teaching and learning development cycle are shown in Figure 2.13. It consists of three phases connected cycles (data gathering, information processing, and knowledge application) and four types of technology assets (organization, computers, theory, and people) (Elias 2011).

The Learning Analytics framework sustains academic rehearsal and learner supervision, potential sureness, course improvement, and useful teaching. This pattern is shown in Figure 2.14 including six various and inseparable parts that are stakeholders, objective, data, instruments, external limitations, and internal limitations. Learning Analytics development is definitely accepted by concentrating on learners' attention as a bottom-up method. Academic progress depend on blending educational information including learners' assurance and their studying (Greller & Drachsler 2012).



Source: Elias (2011)

Figure 2.13: A model of learning analytics for continuous teaching and learning development cycle



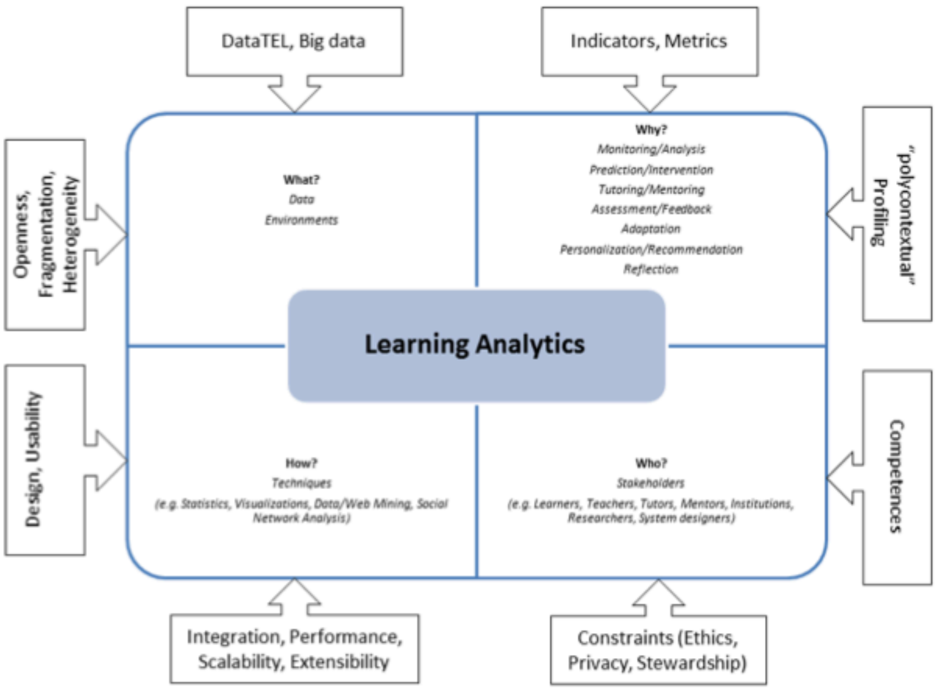
Source: Greller and Drachsler (2012)

Figure 2.14: Learning Analytics framework

'Learning Analytics' is an aim of conducting the fulfilment of definite learning purposes. Learning Analytics also indicates learners' studying experience and learning benefits (Cooper 2012). Learning Analytics rely on four parts of reference model including data and environments, stakeholders, objectives, and methods respectively; see figure 2.15 (Chatti et al. 2012).

Moreover, first part covers building learning and knowledge and is frequently circulated over different media and web sites in networked surroundings; second part covers stakeholders consist of students, teachers, tutors, academic institutes, and other related persons whose attention and objectives are different; third part covers probable aims including monitoring and analysis, prediction and intervention, tutoring and mentoring, assessment and feedback, adaptation, personalization and recommendation, and reflection; last part covers statistics, information visualization (IV), data mining (DM), and social network analysis (SNA).

Prinsloo, Slade and Galpin (2012) claimed that learning analytics involves effects of every stakeholders on learner' studying process for further increasing successful learning. For instance, the Open University (OU) in the UK and the University of South Africa (Unisa) are referred to according to their sharing about challenge, paradoxes and opportunities of Learning Analytics. Learning analytics is shown what causes affect individual's studying progress and success (Rahman & Dron 2012).



Source: Chatti et al. (2012)

Figure 2.15: Learning Analytics Reference Model

Social Learning Analytics (SLA) is a unique subset of learning analytics that absolutely considers both individual accomplishment and collaboration improvement. In addition, Social Learning Analytics should provide studying processes noticeable and practicable at dissimilar scales from country and global networking to small division and private learners (Shum & Ferguson 2012).

SLA has five analysis types: network analysis, discourse analysis, content analysis, dispositions analysis, and context analysis. Especially, social learning dispositions analytics determine that previous knowledge, advance, and aim of learners' question are helpful to bring up online connection (Shum & Ferguson 2011).

Productive SLA display valuable encouragements and occasions for research and business including online social studying, various types of SLA, and analytics achievement (Shum & Ferguson 2012). The efficient SLA are implemented for business and research into technology-improved learning including educational and principled completeness, motivation of online social studying, and understanding various types of social learning analytics (Shum & Ferguson 2011).

Online social learning occurs when human can define their studying goals, describe their problems, and activate learning communications for more understanding. SLA can indicate productive process by good communication and experience sharing in social movement (Shum & Ferguson 2011).

SLA has shown that there are some factors that affect students’ learning development in social networks, and the learning process influences students' successful learning accordingly. However, SLA is not able to show what factors influence peer learning and what the optimal elements of peer learning activities are.

It is well known that technology is integral to and essential for online learning. The differences in technology choice relate to their usability for supporting interaction in peer learning. Therefore it makes sense to compare what technology is best for helping teachers to promote student learning, to encourage students to learn by themselves, and to understand the importance of peer learning for completing their group assignments on time. What is missing in previous research about technology supported online learning is what the advantages of technology are that contribute to the community development of peer learning activities in online environments. The current research study has addressed this issue by answering how technology-supported peer learning activities in an online environment impact student learning experiences.

2.3 Peer learning

Peer learning can lead independent to interdependent as reciprocal learning involvement for participants' knowledge, ideas and experience sharing (Boud, Cohen & Sampson 2001).

Peer learning by reciprocity or equivalence also supported student-centred with lacking teaching help including research students' learning (Boud & Lee 2005).

Peer learning is attainment of knowledge and skill by way of collegial assistance, and all learners are as same social team (Topping 2005).

Peer learning construction based on virtuality concept and organisation learning can make meaningful purpose of studying (Styhre 2006).

Peer learning mentions 'the use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher' (Boud, Cohen & Sampson 1999).

Peer learning includes concept of peer learning, aspects of peer learning, applying peer learning, and impacts of peer learning as follow

2.3.1 Concept of Peer Learning

Although a variety of definitions or explanation for peer learning are presented as above, this research decides for the definition of peer learning by Boud, Cohen and Sampson (1999) which is closely related to the context of research: peer learning mentions 'the use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher' (Boud, Cohen & Sampson 1999).

McLuckie et al. (2009) claimed that learning and teaching are a main objective of educational institutes and are unavoidable affected by career market requirements that need quality and skilled employees. In addition, universities aim to research and improve innovative learning and teaching for various learners (McLuckie et al. 2009).

The purpose of peer learning and peer interaction are emphasizing on the best practice and how to enhance learning and engagement (Bryson 2016; Imlawi 2013).

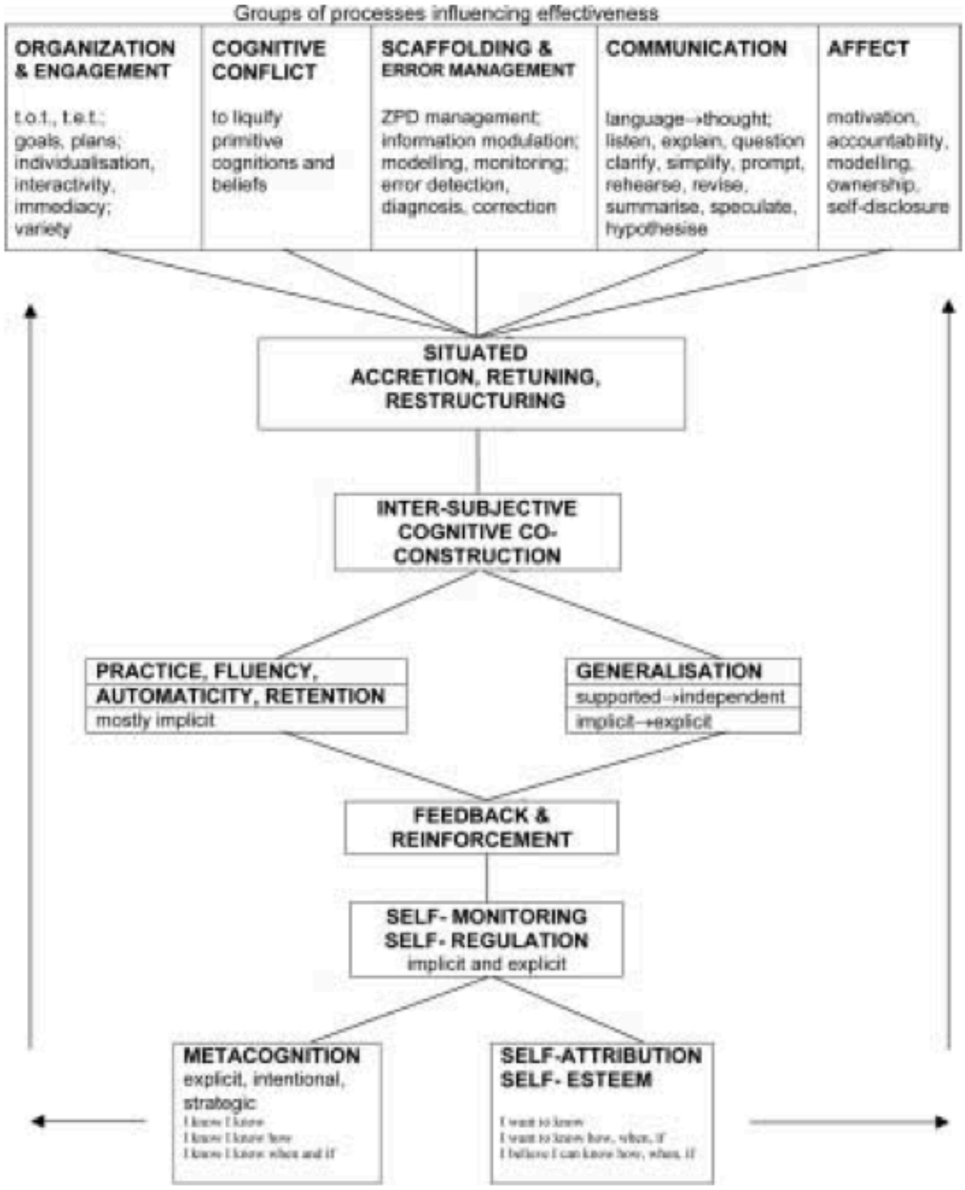
According to university pressure by staff requirements, students' own learning and mutual learning with less schedule issues and no payment are promoted to improve quality of education (Boud, Cohen & Sampson 2001). Boud and Middleton (2003) presented that communities of practice can support learning with and from others within workgroups of organization.

Peer learning is highlighted in the learning process together with emotional encouragement. It should be done systematically so that unfamiliar students can be conscious, improve their skills and get learning occasion entirely (Boud, Cohen & Sampson 2001).

Currently, social and sentimental benefits appeal as much influence as cognitive advantages (Topping 2005). Topping (2005) also stated that Peer *Learning (PL)* has 2 common types that are *Peer Tutoring (PT)* and *Cooperative Learning (CL).* Peer tutoring concentrates on syllabus content and normally on obvious interaction processes that attendee get definite training. Cooperative learning is building positive mutual dependence to meet shared objective (Slavin 1990).

Peer learning can change on curriculum content, contact constellation, within or between institutions, year of study, ability, role continuity, time, place, helper characteristics, characteristics of the helped, objectives, voluntary or compulsory, and reinforcement (Topping 2005). Moreover, plan of peer learning is determined on context, objectives, curriculum area, participants, helping technique, contact, materials, training, process monitoring, assessment of students, evaluation, and feedback (Topping 2001).

Topping (2005) claimed that both peer tutoring and cooperative learning influence academic fulfilment. Theoretical model of peer assisted learning consists of five groups that are organization & engagement, cognitive conflict, scaffolding & error management, communication, and affect (see figure 2.16) (Topping & Ehly 2001). This model indicated that students and peers are contributing and supporting each other. It also increased immediate feedback for learners. Worthy skills that should be transmitted for peer learning including listening, describing, questioning, concluding, estimating, and hypothesising (Topping 2005). Furthermore, keeping pair motivation needs faithfulness and responsibility as well.



Source: Topping and Ehly (2001)

Figure 2.16: Theoretical model of peer-assisted learning

Peer learning in online communities is significant (Topping 2005)), especially transferable skills including both social / affective and interactive process management are significant in online surroundings (McLuckie & Topping 2004). Learners have not only studying by skills of cooperation and assistance but also respectable and worthy participation (Topping 2005).

Teacher achievement expectation consists of teacher confidence, cooperative skill, and student agreement (Abrami, Poulsen & Chambers 2004). Moreover, teacher expectations of learners' effective studying is increased; in the meantime costs of teaching time is decreased (Abrami, Poulsen & Chambers 2004).

University of Dundee in Scotland and University of Applied Sciences Technikum Wien in Austria highlighted virtual learning environment (VLE) on e-learning platform to explore Master's course delivery from paper to virtual and from individual to collaborative (McLuckie et al. 2009). Moreover, collaborative and peer assessment instruments such as e-portfolios, newsletters, discussion forums, Wikis and group puzzles are operated for delivery satisfaction that supports social constructivism studying (McLuckie et al. 2009).

Both Self-Paced and Facilitated Cohort studying approaches are almost the same influence on purposed outcomes of course (Carey et al. 2008). Also, online courses have optimistic effects on teachers' knowledge, pedagogical confidences, and instructional exercises (Carey et al. 2008).

Learners who collaborate with companions require valuable skills including team working and mediation skills, group decision making, and task management together with consideration of group cohesion and mutual reliance (Macdonald 2003).

Layered model of interaction analysis for evaluating online collaborative learning interactions is measured by four indicators: task performance, group functioning, social support, and help services (Daradoumis, Martínez-Monés & Xhafa 2006). It is not only learners who realize both the benefit of their collaboration and abundant feedback to meet their achievement; but also the teacher can advise on individual and group studying activities by using combined evaluation design (for example, Social Network Analysis (SNA)) during and end of each studying phase (Daradoumis, Martínez-Monés & Xhafa 2006)

2.3.2 Aspects of Peer Learning

There are various reasonable point of views in peer learning improvement comprising peer facilitation, community of practice, question prompts & peer interactions, consultation, learner-centred, learner personality, peer assessment, and online peer learning as follows.

Peer Facilitation

Ng, Cheung and Hew (2012) presented that peer facilitation can encounter interaction restriction in nonsynchronous online discussions, and interviews and transcription of online discussion is analysed with recommendation according to learners' satisfaction and others' attitude determination. Furthermore, three levels of online interaction (from low to high) consist of posting of independent messages, posting of feedback messages but lacking in knowledge construction, and posting of constructed knowledge with feedback messages (Ng, Cheung & Hew 2012).

Ng, Cheung and Hew (2012) claimed that researchers can conduct learners' online discussion practiced on five stages of knowledge construction for personal and society including information sharing, opinion disagreement, meaning negotiation, examination of preliminary construction, and recently constructed meaning and knowledge. Ng, Cheung and Hew (2012) stated that the duties of online facilitator include contextualization with discussion announcement, observation, and meta-functions covering refinement and summary.

Ng, Cheung and Hew (2012) also adapted peer facilitation strategies from Bonk and Kim (1998) including asking questions, conducting instruction, providing examples, admiring, preparing cognitive task organising, inquiry for cognitive carefulness, forcing discovery, supporting reflection, promoting connection, and offering general suggestion. It can be found that exact peer facilitation strategies together with tasks pattern in online discussion can enhance interaction in nonsynchronous online discussion board (Ng, Cheung & Hew 2012).

Community of Practice

Vygotsky (1978, cited in Skalicky & Brown 2009, p. 4) stated that knowledge is social construction and learning improvement comes from interactions with teachers and with other learners. Wenger (1998, cited in Skalicky & Brown 2009, p. 5) also claimed that community of practice is created by three basic components including knowledge domain, human community, and shared experience. Community of practice can encourage an occasion for learners' engagement in collaborative and energetic learning surroundings and together with supporting capability of university institute society (Skalicky & Brown 2009).

A Peer learning framework is determined by social constructivism within a model of community of practice, and tool of peer learning planning consists of community of practice, peer learning, and assessment (Skalicky & Brown 2009).

Social learning systems are viewed at level of individual, communities of practice, and organisations especially communities of practice is strong interconnections with knowledge creation, exchange, and alteration (Wenger 2000).

Question Prompts & Peer Interactions

Learners' ill-structured problem solving accomplishment can be developed by scaffolding to simplify cognitive and metacognitive procedures (Xun & Land 2004). Moreover, the scaffolding conceptual framework is formed of both question prompts and peer interaction techniques (Xun & Land 2004). Question prompts are probably more beneficial for learners at the commencement of a period of studying, and both question prompt type and quantity of previous knowledge and experience may influence interaction (Xun & Land 2004).

Swan (2002) presented that student interaction with online discussion is equal to classroom discussion to contribute own reflective and mindful posting with others. Xun and Land (2004) also presented that motivation factors should be tested for successful peer interactions. Salomon & Globerson (1989, cited in Xun & Land 2004, pp. 19-20) explained that collaboration studying should not be restricted to self-knowledge and common interactional procedures, but somewhat, should concentrate on cognitive, motivational, and behavioural procedures in collaborative society.

Both question prompt and peer interaction have four procedures of problem solving consisting of: problem illustration, creating or choosing solutions, building fairness, and observing & assessment (Xun & Land 2004).

Consultation

Topping and Ehly (2001) claimed that Peer Assisted Learning (PAL) is a framework for consulting pedagogical and psychological advisers, and it also combines techniques including energetic and interactive reconciliation of learning in virtue of other learners who are unprofessional teachers, for instance, peer tutoring. In addition, Topping and Ehly (2001) presented that characteristics of PAL are learners' assistance with each other, not to substitute expert instructing, assure benefits for every learners in one or more areas, similar chance basis, and monitoring by skilful teachers with their increased comprehension (Topping & Ehly 2001)).

PAL consists of an amount of various methods that are peer tutoring, peer modelling, peer monitoring, peer education, peer counselling, and peer assessment (Topping & Ehly 2001). Some of these methods will be explained as follow. ‘Peer tutoring’ is the most extensively recognized and it includes tutor and tutee (Topping & Ehly 2001). Topping and Ehly (2001) also stated that it normally highlights on course content. Furthermore, Topping and Ehly (2001) determined efficient peer tutoring should give scholastic usefulness to both tutors and tutees together with their sufficient cognitive demand, better attitudes, and enhanced colleagues’ interactions.

‘Peer Modelling’ is preparation of capable model of pleasant studying behaviour with emulation of group’s constituent and it causes to higher metacognitive consciousness by way of self-instruction (Topping & Ehly 2001). Topping and Ehly (2001) claimed that ‘Peer Monitoring’ implicates peers watching and examining according to colleagues’ suitable engagement and productive learning arrangement with studying manners, and monitoring steps of others’ scholastic operation influence individual’s task and skill improvement.

In addition, ‘Peer Assessment’ is peers’ preparation to determine feedback, status and usefulness of learners’ work and learning outcomes for enhancing learners’ learning capabilities, and it is as conveyance for developing personal assessment (Topping & Ehly 2001).

Learner-Centred

McCombs and Vakili (2005) presented that the framework of learner-centred for e-learning advancement is grounded on Psychological rules of American Psychological Association (1997), and four mentioned areas in learner-centred psychological rules consist of cognitive and metacognitive determinants, motivational and affective determinants, developmental and social determinants, and individual-differences determinants.

Learner-centred is a reaction in operation of learner-centred psychological regulations including plan, rehearsal, strategy, and people that encourage studying for everyone (McCombs & Vakili 2005). In addition, this framework align with technology manners simplifies the organising of learners' connection, and changeable proficiency of teacher and learner can be accepted (McCombs & Vakili 2005). Bonk & Cunningham (1998, cited in McCombs & Vakili 2005, p. 1583) also emphasized the significant of learner-centred regulations, constructivism, and socio-cultural principles for e-learning administration.

Moore (1993, cited in McCombs & Vakili 2005, p. 1597) stated that physical disconnection can cause connection and psychological distancing. Based on learner-centred viewpoint, e-learning can support instruments and capability for learning societies networking to deliver lifelong learners' enhancement (McCombs & Vakili 2005).

Learner Personality

Huang et al. (2006) claimed that model of Kolb's learning cycle with model of human learning behaviour process and model of learner personality can encourage ingenious particularized academic e-learning. Not only Heinström (2000, cited in Huang et al. 2006, p. 355) justified that learner personality affects learning schemes and learning consequences in true operation, but also Wilson (2000, cited in Huang et al. 2006, p. 355) explained that personality may be possible to affect successful education.

Peer Assessment

Juwah (2003) presented that teaching staff desire both productive peer assessment and peer learning to sustain online learning together with certified knowledge, potential, and competency improvement. Peer assessment can support individual assessment (Topping 2005) and instruction based on improvement of capability and standard of participation (Juwah 2003).

It can be acknowledged that assessment has two significant objectives including certification objective and learning objective together with supportive peer feedback and involvement (Liu & Carless 2006). In addition, peer feedback is learning element of peer assessment to improve learners' skills of reflection, listening, evaluation, and justification with others (Liu & Carless 2006).

Juwah (2003) also claimed that Quality Spiral was used to guarantee quality of learning and assessment procedures grounded on learner's purposeful requirements. There are seven steps of peer assessment comprising of

1) explicit rationale
2) engage learners in an authentic learning context
3) involve learners in setting assessment criteria
4) assess learning and give feedback
5) coach for effective performance
6) reflect on own learning and performance
7) tutor check to assure quality

Furthermore, learners are the centre of assessment in regards to their required proficiency and knowledge with trustworthiness, correctness, and equity (Juwah 2003).

Assessment is considered in three groups of online collaborative learning consisting of collaborative discussion, small groups collaboration, and collaborative design of assessments (Swan, Shen & Hiltz 2006). Moreover, students should be communicated learning purposes and assessment rules including well-defined feedback time and criteria preparation at the beginning of a course of study (Swan, Shen & Hiltz 2006).

Online Peer Learning

Topping (2005) stated that online peer learning comes from online peer-assisted learning (Online PAL or OPAL), for instance, online discussion board is an interactive online peer learning circumstance. Online interactions is analysed to present a superiority of social administration problems, instead of intelligent challenge content.

Online collaborative concept mapping is expressed as a beneficial method for peer discourse framework and automatic software instruments in online peer assessment were designed to introduce learners to post comments in reasonable and adjustable ways (Topping 2005).

2.3.3 Applying Peer Learning

Online peer learning can support academic achievement and learning improvement based on suitable learning environment (Razak & See 2010; Topping et al. 2013). Also, learners' community in online peer learning environment is important for learning enhancement (Paus, Werner & Jucks 2012; Tseng & Tsai 2010) although level of revelation modes may be different (Yu & Wu 2011) or unit content design may be an obstacle (Beaumont, Mannion & Shen 2012).

There are various aspects from the literature that have applied peer learning in an online environment. Although all literature agree that learning experience is important, learning experience tends not to be clearly defined and depends on the focus of the peer learning research. Moreover, learning experience is described from slightly different perspectives including teacher, unit content, technology, peer activities, and social relationship or community (Bridges et al. 2014; Eryilmaz et al. 2014).

Although online education has grown, the efficiency of unit design for learner engagement continues to be unpredictable (Revere & Kovach 2011). Moreover, during online studying activities, teachers who expect students to interact with each other and gain meaningful learning (Kop 2010; Loh & Smyth 2010) should build unit content or design unit according to learning improvement (Daves & Roberts 2010; Revere & Kovach 2011; Sakurai et al. 2014).

Technology is an essential component used in the education (Kemp et al. 2014) and it has been used for educational benefits including supporting the communication and interaction between students and teacher or students and their cohort (Schmid et al. 2014). Also, technology can support the flexibility, facilitation and ease of online learning (Abrami et al. 2011). In addition, technology can influence students' belief, preference and learning experience (Kemp et al. 2014; Kukulska-Hulme 2012; Lai, Wang & Lei 2012).

Technology adoption is challenging and must be done carefully to ensure it can influence the improvement of learners' peer learning activities (Pozzi et al. 2007; Wang 2010), and creates meaningful learning by building and sharing learning experiences (Wang 2009, 2010). Teachers can support learner-centred approaches in online peer learning environments by using online technology (Abrami et al. 2011; Caballé, Juan & Xhafa 2008; Revere & Kovach 2011; Wang 2010).

Applying peer learning is related to peer activities, social relationships, and teacher. Peer assessment can enhance the efficiency and quality of learning, so teachers should encourage social relationship of students by using peer assessment to improve interactivity, relationship, self-confidence, and sympathy with peer (Topping 2009); and teachers should be aware of social conflict that can negatively impact knowledge construction in peer learning (Xie, Miller & Allison 2013). Moreover, teacher and social relationship can influence unit completion (Shea & Bidjerano 2010; Traver et al. 2014) and can be affected by role and frequency in participation (Xie, Yu & Bradshaw 2014).

Peer activities is related to social relationship and peer feedback. Offering structured feedback can support peer activities and social relationship to enhance learning sharing (Gielen & De Wever 2012; Moldovan 2014; Mulder et al. 2013). Also, peer activities require social relationship with mutual assistance (Beaumont, Mannion & Shen 2012; Revere & Kovach 2011; Topping 2005; Xie, Miller & Allison 2013; Yu 2011). Moreover, peer learning experienced especially through an online learning environment should be a comprehensive understanding of all those points of view (Topping 2005) including peer assessment (Juwah 2003; Topping 2009), peer questioning (Xun & Land 2004), and peer facilitation (Ng, Cheung & Hew 2012).

2.3.4 Impacts of Peer Learning

Impacts of peer learning includes impacts of online peer questioning, impacts of online peer assessment, and impacts of online peer facilitation/motivation as follows

Impacts of online peer questioning

It is logically supposed that online peer questioning can enhance quality of peer interaction and learning outcomes equal with face-to-face peer questioning (Choi, Land & Turgeon 2008; Johnson 2006). Reciprocal peer questioning influence increasing students engagement using online learning (Johnson 2006).

Reflective thinking of meaningful discussion will occur when learners post meditative questions or contribute crucial feedback (Choi, Land & Turgeon 2005). Therefore, helping students to manage questioning skills is helpful to interactive communication and monitor perception (Choi, Land & Turgeon 2005).

Feedback as dialogue is underlying to closing loop of assessment, and dialogue is one dimension of formative feedback and assessment including supporting peer dialogue, allowing learners to respond feedback, and supporting questioning (Hatzipanagos & Warburton 2009). Especially, supporting questioning is a key assessment process and may benefit from observing significant communication between peers and tutors, for instance, blogs and discussion lists (Hatzipanagos & Warburton 2009).

Cho, Lee and Jonassen (2011) assumed that tasks and epistemological beliefs (for instance, beliefs about knowledge and knowing) would perform a critical role in learning from online peer questioning although there was not entirely support the affirmation of matching both task types and epistemological belief levels.

College students generated low-quality questions asking for refinement and carefulness of opinions instead of high-quality questions producing extreme argumentation and socio-cognitive opposition in directed online discussion (Choi, Land & Turgeon 2005). Because students who lack former knowledge may respond with easy and careless questions for inadequate peers' reflective reasoning, better supportive instruction for creating productive questions should be encouraged (Choi, Land & Turgeon 2005).

Impacts of online peer assessment

Frequent self-assessment influences improving learner achievement (Boud 2000). Especially, setting up assessment as part of curriculum can affect learners assessment in learning society (Boud 2000).

Yang and Tsai (2010) present that approaches to studying through online peer assessment are more related to conception of learning than to learning outcomes.

During early periods of online peer assessment activity, learners with both cohesive studying conceptions and deep learning approaches can increase progress (Yang & Tsai 2010).

Analytic categories for explaining learners' experience of collaborative assessment via e-learning include appropriateness of collaborative assessment, collaborative assessment as learning event, and focus for assessment (McConnell 2002). Furthermore, the assessment form also supports learners to decrease dependency on teachers and to judge quality of learning (McConnell 2002).

Collaborative assessment of learning is an important part of supporting networked collaborative studying with focusing on incorporation of social relationship (McConnell 1999). Moreover, learners satisfied collaborative assessment processes and they feel that their assessment is more reasonable than depending on only tutors' assessment.

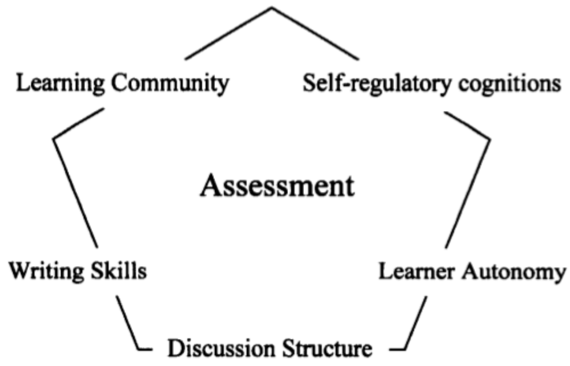
'Peer Assessment' is peers' preparation to determine feedback, status and usefulness of learners' work and learning outcomes for enhancing learners' learning capabilities, and it is as conveyance for developing personal assessment (Topping & Ehly 2001).

Peer assessment is as a means of giving and receiving constructive feedback between students. Also, critical reflection is a key skill connected to giving valuable feedback and can deepen the students' learning experience with similar tasks (O'Farrell 2005).

Collaborative assessment of learning is an important part of supporting networked collaborative studying with a focus on incorporation of social relationships (McConnell 1999). Moreover, learners are more satisfied with collaborative assessment processes when they feel that their assessment is more than depending on only the tutors' assessment.

Assessment is a critical part of learners' learning experience to discover how to improve the quality of learners' studying and of teaching (Keppell et al. 2006) and it is essential to prepare communication point between students (Macdonald 2004). Thus, unsuitable assessment can be useless for peer learning (Keppell et al. 2006). The essential of assessment consists of the certainty of online participation and the encouragement of improvement of online collaborative learning (Macdonald 2003).

Vonderwell, Liang and Alderman (2007) presented that discussion structure, self-regulatory cognitions, learner autonomy, learning community, and learner writing skills are significant factors that influence online assessment activities (see figure 2.17).



Source: Vonderwell, Liang and Alderman (2007)

Figure 2.17: Asynchronous online discussion with multidimensional assessment processes

Peer assessment provides several benefits for the students' process of studying (Planas Lladó et al. 2014). Students also feel that peer assessment is a powerful assessment tool for both assessor and assessed (Gielen, Dochy & Onghena 2011; Planas Lladó et al. 2014). They are eager to cooperate in their self-assessment and are more involved in their own learning (De Wever et al. 2011). Moreover, peer assessment allows students to learn from their own mistakes and those of their cohort (Planas Lladó et al. 2014).

Peer and Self-Assessment are used in massive open online courses (MOOCs) as an opportunity for students' for assessment and learning by guided rubric with explicit wording and well-specified measurement (Kulkarni et al. 2015).

Using online peer assessment tools is associated with positive student attitudes. The differences of attitude are attributed to given instructions, teachers' skill level, and appropriate assignment type. To gain positive students' attitudes about online peer assessment, teachers should give students the explicit instructions and the expectations from them together with the appropriate time and length of peer assessment assignment. In addition, online peer assessment is a simple tool for students' reflective thinking and learning after a review of their peer feedback (Collimore, Paré & Joordens 2015)

Impacts of online peer facilitation/motivation

The course facilitator encouraged participants' communication by initiating learners' interaction together with posting questions and sending email instantly to individual learner (Carey et al. 2008). In addition, enormous facilitation or interaction can deliver same learning consequences. Facilitators manage significant average interaction time, task, feedback, email, and online discussions (Carey et al. 2008). High learning motivation influences studying for examination and is independent of the type of instructional tools and learning outlines (Su et al. 2010)

Peer learning has the effect of increasing and sharing learning experiences. It consists of various activities for learning and interaction together, for example, peer questioning, peer assessment, peer facilitation and peer motivation. Also, each activity has different features and objectives. It is important to consider how to maximize the benefits of peer learning activities with regard to the student learning experience. What is missing in previous research about peer learning is what influences interaction when engaging in peer learning activities in an online environment and what are the enabling elements of peer learning activities in this environment. The current research study has addressed these issues by investigating the factors that promote or hinder peer learning in an online environment and how technology-supported peer learning activities impact students' learning experiences.

2.4 Student Learning Experience

Student learning experience includes pedagogy supported learning, learning experience with individual learning style, and psychology supported learning with learning communities as follows

2.4.1 Pedagogy Supported Learning

Pedagogy supported learning is related to academic institute, online/distance learner, and Problem-Based Learning (PBL) as follows

Academic institute

Annand (2008) claimed that the variable expenses of online courses include production staff time, teachers, online delivery system and marketing. Moreover, the important cost attributes show cash flows that can be anticipated in the future and are district under the various options. In the future, both cash flows and time value of money should be considered. In addition, cost of all resources required to deliver product or service are also evaluated based on time-driven and activity-based costing.

Parker (2008) presented that quality standard of online education is built for measurement. Online learning is a circumstance that consists of collaboration, communication, and involvement content with definite group and free learning actions and tasks (Sims, Dobbs & Hand 2002). Within the essential frameworks for universities in Australia, 'Universities are expected to engage in a pro-active, rigorous and ongoing process of planning and self-assessment which enable them to ensure the quality outcomes expected by their students and the wider community' (Department of Education et al. 2000).

The Quality Assurance Agency for Higher Education (QAA) has a 2004 handbook revision including a concentrate on learners' learning experience, peer review, enhancement of self-evaluation, for instance. In addition, Quality Matters (QM) is designed to certify the quality of online courses and QM is based on national standards of best practice, the research findings, and instructional design principles.

Online/distance learner

A unique challenge is with a definite mode of online studying: non-cohort learning (Croft, Dalton & Grant 2010). Although this provides flexible activities and time for students by not using peer communication, issues of successful learning experience and sense of learners' community cannot absolutely be done (Croft, Dalton & Grant 2010). In addition, sharing knowledge to develop students' studying and understanding is an important part of personal cognitive enhancement and this form of learning is presented as a problem (Vygotsky 1978).

Learner-centred studying is more important than technology-centred as Personalized E-learning Environment (PELE) system develops further reflective and participatory lifelong learning. PELE permit learners to access, save and manage information and documents from internal and external sources using available functionalities. Learners can interact to e-learning more powerful and convenience participation by their personal studying and resources (Webster 2008).

Conceptual model of "Learning at University" is improved to help learners' self-learning with more understanding skill. This model is combined with learner, teacher, administrator, university and society who communicate and operate in potential and constraint environment integrated with lecture, tutorial and workshop skill (Webster 2008).

Petrova and Sinclair (2008) claims that the improvement and assistance of learning is identified by using different information and communication technologies. E-learning and stakeholder framework is used based on stakeholder groups' consideration. Their groups are academics, organization and students which interact to e-learning environment and plan to clarify criteria of e-learning evaluation, pattern usage and learners' satisfaction (Petrova & Sinclair 2008).

The students' value criteria concentrate on materials, teaching, and course detail. Students consider five parts for creating the valuable framework of e-learning including accessibility, components, satisfaction, learning experience and online interaction (Petrova & Sinclair 2008). The issues related to five values are how necessary to access to e-learning, which components are essential, whether satisfaction would suggest any course, whether students' experience are anticipated, and whether interaction is sufficient respectively (Petrova & Sinclair 2008)

Problem-Based Learning (PBL)

Problem-based Learning (PBL) is an educational technique by problem exploration and determination (Torp & Sage 2002). The advantages for learners who work as team in PBL are learners' cooperation, learning accomplishment, communication proficiency, personal knowledge building, and partnership skills (Keating & Gabb 2006).

Problem based learning (PBL) is technique of instructing and proficient studying based on Socratic teaching, constructivism, and group accommodation (Rogal & Snider 2008). Students are motivated by asking questions to further their self-knowledge improvement. PBL reinforces learners' decision making by supporting in perceptive and critical thinking; and linking between theory and practice (Facione 2006; Rogal & Snider 2008).

Maastricht-Schmidt's 7-jump model of problem based learning (Schmidt 1983) consists of

- 1st jump - clarifying concepts
- 2nd jump - identifying problem
- 3rd jump - analysing problem and brainstorm
- 4th jump - problem analysis and statement formation
- 5th jump - formulating learning goals
- 6th jump - independent self-directed study and
- 7th jump - discussion respectively

Rogal and Snider (2008) also presented that the important objectives of PBL are the obtainment of knowledge, skills and modified behaviour.

Although Colliver argued that the result of using PBL is little different from traditional education approach (Colliver 2000), there are two more explanation: PBL is pleasant and stimulating studying method; and PBL should be considered and examined by well-organized & evaluated research (Norman & Schmidt 2000). Innes (2006), stated that problem-based learning groups by talk communication can build desirable and great knowledge over classroom; no connection is no education. Beneficial knowledge can find solution and make talent for learner on the far side of classroom (Bransford, Brown & Cocking 1999).

During learning communication, students are motivated to find out solutions of their real problems along with their objectives (Csikszentmihalyi & Schneider 2000; Lee & Smagorinsky 2000; Peterson & Miller 2004; Schank 1999). Lan et al. (2012), claimed that Computer-Mediated Communication (CMC) tools have two connection ways that are online "asynchronous" discussion and "synchronous" communication. Group of learners using mobile (for online asynchronous discussion) affect to learners' learning achievement and further responding intention, sharing knowledge, and accommodating social knowledge building with their learning group.

Dochy et al. (2005) presented that the attribute of PBL are significantly influenced on the appearance of effective learning surrounding. The main characteristics of great learning circumstances are identified by PBL, including self-directed student-emphasized learning procedure, knowledge sharing, facilitator's assistance in social connection, and clarified problem for ultimate solving related to learners' knowledge (Barrows 1986; Van den Bossche, Gijbels & Dochy 2000).

The three sequential stages of PBL are problem analysis, self-directed learning and reporting; and Model of structural equation is used for analysing learners' studying. Learning in each PBL stage is increasing and influenced by previous stage and all stages impact on successful studying. In self-directed learning stage, not only personal education but also teamwork (Yew, Chng & Schmidt 2011).

Self-Directed Learning (SDL) and Self-Regulated Learning (SRL) are evolutional procedures and the self-feature is important. SRL is determined as a student attribute but SDL is as both student attribute and appearance of circumstance (Loyens, Magda & Rikers 2008).

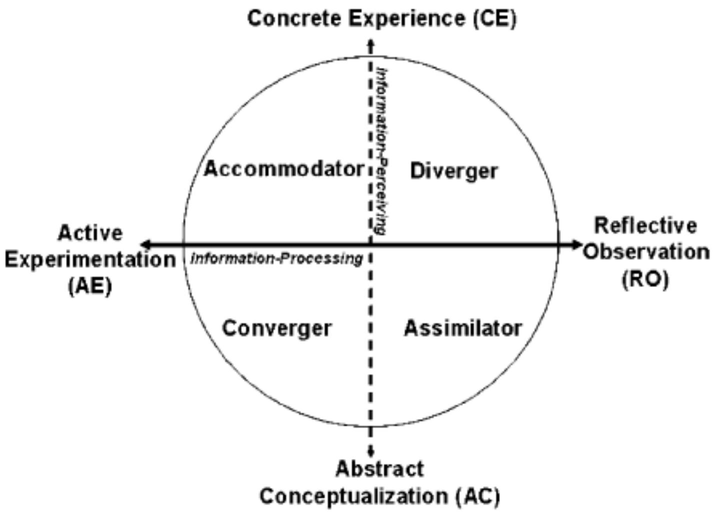
Well-supplied media for self-studying can support joiners to understand manipulated technology and PBL ideas for further concentration on teamwork movement. Involved learners were accustomed to Web 2.0 technology, for instance, Wordpress, wikis and Skype for sharing new knowledge via network education (Nerantzi 2012). Students are interested in network learning by MOOCs over obstacle of different educational institutes (Downes 2010; Nerantzi 2012).

Excellent online communication improves involved learners' learning progress by building public society (Donnelly 2010; Wenger, Trayner & De Laat 2011a). Joiners should understand their tasks before connecting in network group (Shea 1994).

Learning Experience with Individual Learning Style. Each learner has specific learning experiences that can be influenced by personal learning environment (Kop 2010). Different learners have their own various learning and level of critical literacies for making confident engagement and participation with their learning activities. Also, learning environment should be ready and helpful for learners at the beginning of learning (Kop 2011). There are six principles for creating meaningful learning experience including (1) time and duration (2) interactivity (3) intensity (4) sensorial and cognitive triggers (5) breadth and consistency and (6) significance and meaning (Shedroff 2009). Learning style can affect personal academic proficiency

(Kolb 1984; Wang et al. 2006). Learning style is defined as 'characteristic cognitive, affective, and psychological behaviours that served as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment' (Keefe 1991).

Using Kolb's learning styles model (see figure 2.18, adapted from Kolb 1984), the model concentrates on how individual student experiences and process information. Learning process cycle iterates with four learning modes including Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). There are four learning styles including accommodator, diverger, assimilator, and converger. Diverger combines the features between CE and RO. Assimilator combines the features between AC and RO. Converger combines the features between AE and AC. Finally, accommodator combines the features between AE and CE. Moreover, both learning style and formative assessment are essential factors for successful online students. (Wang et al. 2006).



Source: Adapted from Kolb (1984)

Figure 2.18: Kolb's learning styles and learning modes

2.4.2 Psychology Supported Learning with Learning Communities

Psychology supported learning includes cognitive strategies and social constructivism / learning communities as follows

Cognitive strategies

Swan (2005) presented that cognitive constructivism is significant because it locates cognitive processing of assimilation and accommodation to achieve mental construction linking learners' existed knowledge with new learning.

Gagné (1972) claimed that learning outcomes have five important groups including 1) verbal information 2) intellectual skills 3) cognitive strategies 4) attitude and 5) motor skills (see table 2.3).

Table 2.3 Gagne's Taxonomy of Learning Outcomes

Learning Outcome	Definition
Verbal information	Stating previously learned material such as facts, concepts, principles and procedures
Intellectual Skills	
Discrimination	Distinguishing objects, features, or symbols
Concrete concepts	Identifying classes of concrete objects, features, or events
Defined concepts	Classifying new examples of events or ideas by their definition
Rules	Applying a single relationship to solve a class of problems
Higher order rules	Applying a new combination of rules to solve a complex problem
Cognitive Strategies	Employing personal ways to guide learning, thinking, acting, and feeling
Attitudes	Choosing personal actions based on internal states of understanding and feeling
Motor skills	Executing performances involving the use of muscles

Source: Gagné (1972)

Bloom's Taxonomy of Cognitive outcomes consist of knowledge, comprehension, application, analysis, synthesis, and evaluation (see table 2.4) (Bloom et al. 1956).

Table 2.4 Bloom's Taxonomy of Cognitive Outcomes

Knowledge	Remembering previously learned material, including facts, vocabulary, concepts, and principles
Comprehension	Grasping the meaning of material
Application	Using abstraction, rules, principles, ideas, and other information in concrete situations
Analysis	Breaking down material into its constituent elements or parts
Synthesis	Combing elements, pieces, or parts to form a whole or constitute a new pattern or structure
Evaluation	Making judgments about the extent to which methods or materials satisfy extant criteria

Source: Bloom et al. (1956)

Learning theory describes the relationship between the thing that is learned and the restriction when learning happens. Moreover, knowledge must be implied from visible behaviour. Cognitive strategies include various approaches by which learners conduct their own learning, thinking, acting and feeling. Attitudes obtained internal situation that control option of individual activity. In addition, attitude construction consists of informational component, behavioural component, and emotional component.

Clark and Mayer (2008) states that learner's behaviours should be considered according to available lessons. If learners have a large number of background knowledge or experience, they do not need e-learning instruction. However, cognitive human learning may work depend on learner's information transformation. It can be seen that visual screen consisting of words and images will affect long time learning (Clark & Mayer 2008). Moreover, representational graphics selection may support learning to help learner understanding more with instructional message (Clark & Mayer 2008).

Learning is more productive when explanation and graphics are combined for any electronic lesson. Effective learning is improved by promoting on-screen personalisation with friendly and polite conversational style. Breaking the lesson into controllable segments may help learner, who is unfamiliar with it, can continue to study content step by step without overloading the learner's cognitive ability (Clark & Mayer 2008).

Suitable and essential examples in e-learning are promoted in significant way and are produced for giving self-explanation, less learning time and more effective. They should be in sequence and can be passed to fulfil an exercise. Determining the number of questions in each exercise for learner interaction should be provided between sessions and responded precisely and fast (Clark & Mayer 2008).

Learner thinking performance and prosperity are led by human (user) activity, efficient task and computer design. User activity is related to physical, cognitive, affective and usefulness resources which are achieved the potential function of HCI. Different learners found distinct complication of same task, so HCI is as bridge between user and computer to interact and support users' intention and evaluation (Te'eni, Carey & Zhang 2005).

Norman's seven-stage model of user activity describes and differentiates the achievement of task by the sequence steps of 1) to set up the objectives 2) to intend the goals 3) to indicate the action step 4) to run the action 5) to realize the status of system 6) to explain the system status and 7) to evaluate the relationship between the explanation and the anticipation based on intentions (Te'eni, Carey & Zhang 2005).

McKay (2008) claims that the interacting mental habits are extravert, introvert, thinking, feeling, sensing, intuitive, judging and perceptive. The human dimension is shown that users are in all stage of design and development of information systems for further production usability with effectiveness, efficiency and satisfaction. In addition, user expectations come from different goals that are satisfying, fun, emotionally fulfilling, rewarding, supportive of creativity, aesthetically pleasing, motivating, helpful, entertaining, enjoyable, easy to remember how to use, efficient to use, effective to use, safe to use, have good utility, and easy to learn.

Nevertheless, learners should be provided with suitable instructional structures, online environments and tools that support collaborative problem solving, and aggressive and flexible information systems (McKay 2008).

Huang et al. (2006) presents context-aware semantic e-learning approach to combine content preparation, learning procedure and learner individuality in semantic e-learning framework. The intelligent semantic e-learning framework combined with three components which are semantic context model, intelligent personal agents and conceptual learning theories

The three stages of intelligent an e-learning scenario are pre-learning process, learning process, and post-learning process. Pre-learning process covers work preparation of learners and teachers. Learning process covers learning activities such as addressing learning materials, writing consideration, and self-evaluation and revision. In addition, learning signals is used for users' communication and system. Post-learning covers reporting and evaluation of learning results for learner and teacher. Anyways, concrete evidence and decision-making impact learning and teaching improvement (Huang et al. 2006).

Human / Learner behavioural process is represented to show that external environments and internal physiology and psychological may affect to learning process. Structure of personality model in e-learning has two basic parts which are common static aspects and dynamic aspects. Common static aspects have occurred and fixed when human is adult. These are traits, talents, and orientations. Dynamic aspects are unique to each person and changeable forever. These are mood, values, attitudes, beliefs, abilities, habits, preferences, long-term goals, self-concept and short term on emotions and immediate goals. Both parts of aspects may identify the learners' personality (Huang et al. 2006).

Liu, Magjuka and Lee (2006) claimed that there are three types of collaboration: student-content, student-student, and student-teacher. The social performance is commonly supported helpful surrounding and society feeling to assist learner cognitive learning procedures (Liu, Magjuka & Lee 2006). Moreover, online learners as social character are provoked and encouraged to community of query (Anderson et al. 2001). Social weakening influences the expansion of drop-out rate of online learners who are lonely (Liu, Magjuka & Lee 2006).

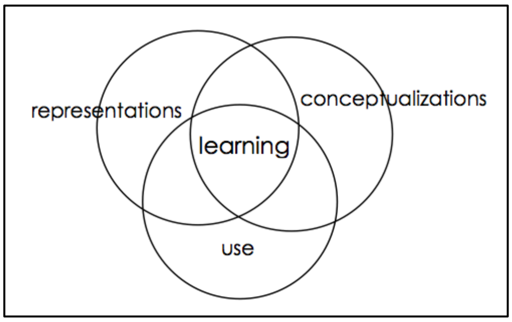
Asynchronous online learning can build prosperous cognitive presence competent for encouraging effective studying based on concept of thoughtful inquiry, self-direction, and metacognition (Garrison 2003).

To create a productive online learning community and contribute to online learning experiences from both teacher and learner perspectives, Cognitive Apprenticeship Model (CAM) with four measurements in any learning environment including content, method, sequencing, and sociology are considered (Boling et al. 2012).

Social Constructivism / Learning communities

Constructivism is a learning theory and relevant to psychology in which knowing and learning are shared. All learning is connected to experience and circumstance of experience notwithstanding where learning occurs. Furthermore, pedagogy and learning surroundings are designed as learner-centred, knowledge-centred, assessment-centred, and community centred by constructivist learning theory (Swan 2005). Social Constructivism based on work of Lev Vygotsky, cognitive skills and thinking patterns are the outcome of social activities, and knowledge construction through social interactions are major concerned (Daniels 2012; Swan 2005).

Research Centre for Educational Technology (RCET) model of Technology Supported Learning within social constructivist structure differentiates three interacting areas of knowledge creation: conceptualization, representation, and use (see figure 2.19) (Swan 2005). In part of (external) knowledge representation, this model encouraged what kinds of activities and tools can engage online learners. In part of (individual) knowledge conceptualisation, learners' mental models of communication and learner characteristics are considered to sustain learners' knowledge creation based on technologies utilization. And in part of (social) uses of knowledge, social interactions and activities as social supports are mentioned according to created knowledge and learning.



Source: Swan (2005)

Figure 2.19: RCET model of Technology Supported Learning within social constructivist structure

Learning is a procedure completed by individuals and teams. Knowledge or skill comes from learning; and capability is shown according to learners' significance. Building a prosperous conduction to learning consists of four general varieties that are learning capabilities, learning individuality, learning narrative, and learning relationships (Crick, Broadfoot & Claxton 2004).

Smith & Spurling (1999, cited in Crick, Broadfoot & Claxton 2004, p. 250) explained that the emphasis on continuousness, determination and expansion policy in individual learning are implemented by four rules of individual studying engagement, community studying engagement, honour for others' studying, and honour for truthfulness. The Effective Lifelong Learning Inventory (ELLI) evaluation tool identifies proportion of learning displaying optimistic learning relationships are considered personal studying, others studying, society relationships with a divergence point of dependence and individualism. ELLI focus on student-centred that means understanding learners' aspects with their abilities, encouragement, and qualified communication comprehend the beginning point for teaching instead of more typical lessons (Crick, Broadfoot & Claxton 2004).

Duchesne (2013) claimed that 'Constructivism is an explanation of learning that views it as a self-regulated process that builds on learners' existing knowledge, and in which learners are active participants'. There are various forms of constructivism, and two of them are 'psychological constructivism' and 'social constructivism'. On the one hand, psychological constructivism concentrates on personal learners and how they build their knowledge, trust, and individuality; but on the other hand, social constructivism highlights the function of social and cultural determinant in forming learning (Duchesne 2013).

The viewpoint of social constructivism is that social interaction forms cognitive improvement, and is a necessary element of learning process (Duchesne 2013). In addition, constructivism has four key rules including 1) learners are active contributors in learning, 2) learners are self-controlled, 3) social collaboration is essential for productive learning, and 4) learners' knowledge may be related, because learners build their own significant factors, for example, previous knowledge and sociocultural circumstance.

The constructivist approach supports learner-centred experiences and actions, prepare learners' chance to work together, and help beginner learners to enhance skill. There are different ways of being capable of learner work together including cooperative learning, collaborative learning and peer-assisted learning. Constructivist rules consist of cognitive tools or framework to help learners' learning (Duchesne 2013).

The social presence of facilitators and of participants can encourage people's engagement and active participation together with the community creation and the feeling of belonging. When the level of presence in connectivist learning is increased, it improves the comprehension of learning and consequently the learning experience. (Kop 2011).

A cohesive online community was an important element for students' learning experiences in online environment. Sense of community with formative feedback and companionship among learners are challenges for online learning (Boling et al. 2012).

Moreover, ICT prepares various resources for learners to use for solving problems, considering, indicating, and collaborating with others within classrooms and access to online environments. ICT also furnish functions for students to create shared significant and to collaborate together (Duchesne 2013).

Each student's learning experience is different. For instance, some students can learn faster than others. It is significant to consider how students can share the learning experience with each other and how peers can support each other to develop their own learning experience. Each activity of peer learning involves both students and teachers. Students receive the encouragement of both their peers and their teacher in support of learning and teaching. Moreover, available technology should consider both asynchronous and synchronous modes. What is missing in previous research about student learning experience is the impact and position of the teacher on peer learning activities in an online environment. Again, the current research study has addressed these issues by addressing the factors that promote or hinder peer learning activities in an online environment and asking how technology-supported peer learning activities online impact student learning experiences.

2.5 Chapter summary

This chapter has provided a review of literature in relation to the three key domain areas covered by this research. The first section covers technology supported online learning with a focus on the importance of specifically selected technology support in order to have successful learning outcomes. The second section provides an overview of peer learning together with concepts, aspects, applying and impacts of peer learning in online environment. The third and final section covers students' learning experience with pedagogy supported learning, individual learning style, and psychology supported learning with learning communities.

Previous research has already identified the influence of a range of factors on peer learning including: the attribute of individual student; the role and behaviour of teaching team; student understanding of the unit requirements; natural events and experiences of peer activities; supporting of social relationships; and the design, adoption and use of information technology. However, exploring their relationship and how they influence student learning experience is still limited.

Chapter 3: Methodology

3.1 Introduction

This chapter presents the methodology that was used in undertaking this research. It covers the philosophical perspective, the research strategy employed, the overall design of the research, the approach of data collection and data analysis, and finally how researcher bias was addressed.

This chapter is divided into the following eight sections:

- Section 3.2 presents the research aims, questions and objectives for which this research has been designed to provide answers
- Section 3.3 describes the philosophical underpinnings of the research which adopts a subjective ontology and an interpretivist epistemology.
- Section 3.4 discusses the research strategy employed. The methodological aims are stated along with the use of a case study approach, and three stages of data collection and analysis are presented.
- Section 3.5 presents the research design which covers concurrent triangulation approach over four phases: Preliminary phase; Baseline phase; Redesign phase and Outcome phase.
- Section 3.6 describes the tools and techniques for data collection including discussion board, survey, focus group, and semi-structured interview. This section also presents the ethics procedures encountered in undertaking research by collecting data from students and teaching staff.
- Section 3.7 describes the approach taken to the data analysis.. The statistical data from discussion board used social network analysis. The survey data from online survey used descriptive spreadsheet analysis and factor analysis. The interview transcript from semi-structured interview and focus group were analysed using a thematic coding.

- Section 3.8 describes the approach to interpretation and discussion of the results obtained from the analysis of the data collected.

- Section 3.9 discusses the researcher bias for this research.

3.2 Research Aims, Questions and Objectives

This section frames this chapter by presenting the aim of the research. The two Research Questions along with their Research Objectives.

3.2.1 Research Aims

In this context, this research aims to:

1. Investigate the role and usefulness of peer learning activities in an online environment for contributing to students learning experiences;
2. Implement a set of technology-supported peer learning activities and evaluate their impact on the student learning experience in an online environment;
3. Generate a framework for supporting online peer learning unit designs that optimise students learning experiences

3.2.2 Research Questions and Research Objectives

This research intends to answer the following research questions with their objectives.

Research question 1: What factors promote or hinder peer learning activities in an online environment?

- Objective 1: To determine the enabling elements of peer learning activities in online environment

- Objective 2: To determine the impact and position of the teacher on peer learning activities in online environment

Research question 2: How do technology-supported peer learning activities in an online environment impact on students' learning experience?

- Objective 3: To determine what influences interactions when engaging in peer learning activities in online environment

- Objective 4: To determine what the affordances of technology are that contribute to the community development of peer learning activities in online environment

Figure 3.1 provides an overview of the methodological approach adopted in this research. Each stage will be discussed in detail in the following sections.

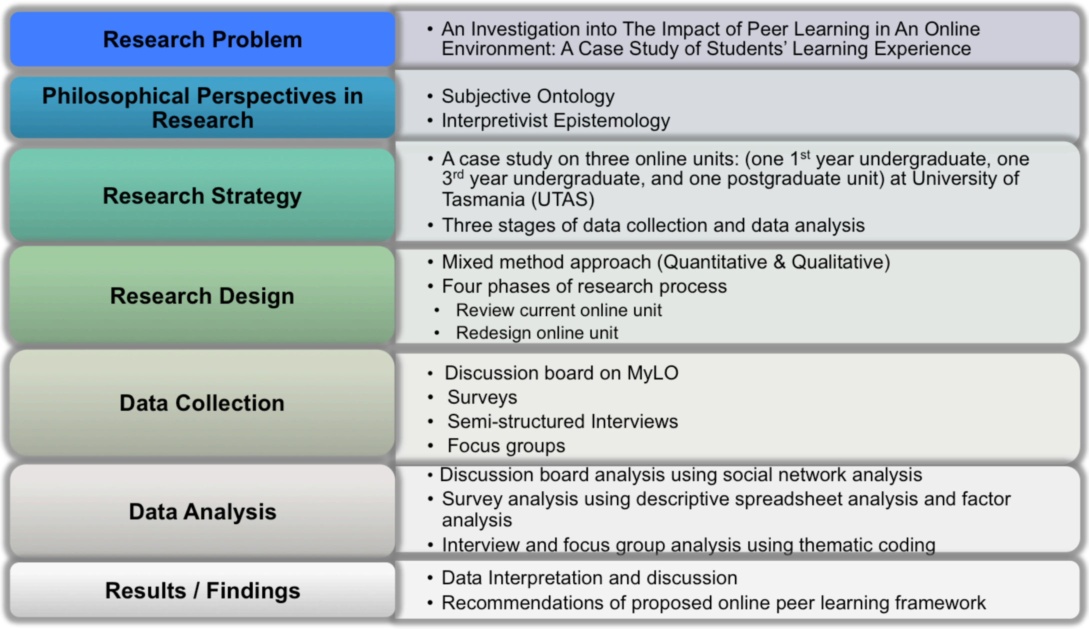


Figure 3.1 The organization of research methodology

The next section presents the research philosophy and introduces the ontological and epistemological positions taken by the researcher.

3.3 Research Philosophy

When undertaking research it is important that an underlying philosophy about knowledge be identified and how it can be obtained (Trauth 2001). This section presents the research philosophy and introduces the ontological and epistemological perspectives taken by the researcher. The research aims to investigate the impact of peer learning in an online environment for enhancing students learning experience. The research philosophy underpinning the methodology will adopt a subjective ontology and an interpretivist epistemology that will be explored further in the following sub-sections.

3.3.1 Ontology

An ontological perspective is important to consider because research is to understand world of the truth that is different (Creswell et al. 2007) and the truth is created by humans (Guba & Lincoln 2005). Ontology is the thing that exist and describe the nature of essential properties and relations of all beings. Ontology is the empirical world that may be associated with humans (subjective) or independent of humans (objective) (Orlikowski & Baroudi 1991).

Ontology is defined as ‘Whether social and physical worlds are objective and exist independently of humans, or subjective and exist only through human action’ (Orlikowski & Baroudi 1991, p. 8). Neuman (2014, p. 94) describes ontology as ‘An area of philosophy that deals with the nature of being, or what exists; the area of philosophy that asks what reality is and what the fundamental categories of reality are.’

Subjective stance is considered for understanding participants’ subjective experiences. Moreover, researchers and participants are able to work together to build social realities (Teddlie & Tashakkori 2009). Subjectivism is recognized to reflect on whether it helped or obstructed objective comprehension and its values to improve objectivity (Ratner 2002).

The researcher views reality as being subjective where people’s activities and interpretations state their world (Orlikowski & Baroudi 1991). Becoming familiar with technology supported peer learning activities and requires understanding the meaning that people involve to their environment. Therefore the research is directly concerned with meanings the students learning experiences are influenced to change and that no one sees the data in the exact same way.

A subjective ontology is adopted for this research because the researcher is able to demonstrate subjective facts of research participants’ peer learning activities and interpretation of their involved circumstances. Moreover, subjective ontological approach provides the perspectives of reality through sharing meanings (Walsham 1993). This research is considered the exploratory for seeking more detail the students’ learning experience during peer learning in an online environment together with investigating the impacts of technology supported peer learning activities.

3.3.2 Epistemology

Epistemology is defined as ‘An area of philosophy concerned with the creation of knowledge, focuses on how we know what we know or what are the most valid ways to reach truth’ (Neuman 2011).

Epistemology is the theory or science of the method or grounds of knowledge and it is the study of how we know the truth. It has focused on analysing the nature of knowledge and how it relates to connected notions such as truth, belief, and justification. Epistemology includes two philosophical positions: positivism (miss the subjective) and interpretivist (concern the subjective) (Weber 1997).

Epistemology is relevant to the knowledge assumptions and how it can be gained. The interpretivist research supposes that research participants build and connect their own subjective and inter-subjective consequence as they interact with their surroundings (Avison & Myers 2002).

Interpretivist believes that social reality is created through the social people who interact with each other. Interpretivist research concentrates on complete complexity of human action and situation (Myers 1997; Neuman 2011). It is to interpret, explain, or generate the meaningful context with understanding. That also means context can affect to information system (Myers 1997; Walsham 1993).An interpretivist epistemology is adopted for this research because the researcher believes that research participants make their own learning experience when they interact together within their circumstance. Different research participants also have various learning experiences.

This research was undertaken using a subjective ontology along with interpretivist epistemology as the research intends to better understand the impact of peer learning in an online environment and investigate how and why technology supported peer learning activities can be obtained for improving students’ learning experience.

Section 3.3 presented the underpinning reasons for why this research was conducted with a subjective ontology and an interpretivist epistemology. The next section introduces the research strategy of this study.

3.4 Research Strategy

This research investigated the impact of peer learning in an online environment and how to enhance students learning experience. This research focused on the use of case study as a strategy to follow the involvement of students and teaching team in educational online units.

3.4.1 Case study

Case study is an inquiry strategy for researcher to find out information in depth on event, activity, process, and one or more person. Boundary of case study is by time and activity. Moreover, researchers are able to collect detailed information by using various data collection approaches during a given time period (Creswell 2009; Stake 1995). The characteristics of case study approaches are presented in the following table 3.1 (Creswell 2013).

Table 3.1 Characteristics of Case Study Approaches

Characteristics	Case Study
Focus	Developing an in-depth description and analysis of a case or multiple cases
Type of Problem Best Suited for Design	Providing an in-depth understanding of a case or cases
Discipline Background	Drawing from psychology, law, political science, and medicine
Unit of Analysis	Studying an event, a program, an activity, or more than one individual
Data Collection Forms	Using multiple sources, such as interviews, observations, documents, and artifacts
Data Analysis Strategies	Analyzing data through description of the case and themes of the case as well as cross-case themes
Written Report	Developing a detailed analysis of one or more cases
Source: Creswell (2013)	

To determine the appropriateness of case study approach, the eleven characteristics are shown in table 3.2 (Benbasat, Goldstein & Mead 1987). This table is presented the key characteristics of case studies relating to this research that are demonstrative of the suitableness of the case study approach for this research.

Table 3.2 Key characteristics of the case study methodology

No	Key Characteristics of Case Studies	Application to this Research Study
1	Phenomenon is examined in a natural setting	This study was conducted during semester, exploring the interactions of the students in a live example by observing their learning.
2	Data are collected by multiple means	This study has collected data by online survey, discussion board, semi-structured interviews and focus groups
3	One or few entities (person, group or organization) are examined	This study has involved the particular groups of teaching teams and students enrolled in each of the educational units investigated
4	The complexity of the unit is studied intensively	This study has explored how to improve the learning experience of the students by investigating the impact of peer learning in online environment using online survey, discussion board, semi-structured interviews, and focus groups
5	Case studies are more suitable for exploration, classification and hypothesis development stages of the knowledge building process	This study was conducted using a process of investigation that included engagement with specific environments to support the capacity to compare results and test hypotheses to generate its findings.
6	No experimental controls or manipulation are involved	This study has not the involved experimental controls or manipulation
7	The investigator may not specify the set of independent and dependent variables in advance	This study has not specified the set of independent and dependent variables in advance
8	The results derived depend heavily on the integrative powers of the investigator	This study has drawn the result by the comparative analysis before and after testing redesigned units with regard to reliability and validity
9	Changes in site selection and data collection methods could take place as the investigator develops new hypotheses	This study has developed the redesigned units for testing the changes of students' learning experience during different periods of time as the basis for comparison.
10	Case research is useful in the study of "why?" and "how?" questions because these deal with operational links to be traced over time rather than with frequency or incidence	This study has collected data of students' interaction from discussion board and online survey of students together with focus groups of students and semi-structured interviews with the teaching team. All data support each other as triangulation of quantitative and qualitative data was conducted.
11	The focus is on contemporary events	Research area is contemporary and up-to-date while online learning still grows speedily
Source: Benbasat, Goldstein and Mead (1987)		

Therefore, case study approach was deemed the most appropriate approach for this research as it involved participants and technologies in three educational units at the University of Tasmania accordingly.

3.4.2 Three stage approach

Three stage approach was used in this research. The data collection and data analysis for the research was structured into three research stages from four phases of research process (see figure 3.2 & 3.3).

The first two data collection and data analysis stages focused on finding out what peer learning activities used, how teaching team supported students online learning, and how technology supported peer learning activities including how students were engaged and interacted with each other accordingly. At the end of these two stages, recommendation of redesigned unit was developed and discussed with unit coordinator of two educational units for further testing redesigned unit in final stage.

The final data collection and data analysis stage aimed to develop framework of recommendation for online peer learning: enhancing student learning experience. Data from first two stages as pre-redesigned unit data was employed for producing data from final stage as post-redesigned unit data as well.

Section 3.4 has presented the research strategy that utilised to ensure the research objectives were fulfilled and that detailed insights were obtained in regards to the research questions. This section has demonstrated how case study and three stage data collection and data analysis strategy was appropriate for the philosophy perspectives of this research. The next section presents the research design.

3.5 Research Design

The research design was guided by the research philosophy (see section 3.3) and the research strategy (see section 3.4) to implement the research process over four phases including three stage data collection and data analysis with choosing mixed method approach with convergent triangulation approach. The four phases of research process consist of:

The four phases of research process (see figure 3.2) are:

- Preliminary phase was selecting and assessing units for the case study;
- Baseline phase was the data collection and analyses of existing unit delivery;

- Redesign phase involved the development, implementation and evaluation with unit re-design to enhance students learning experiences and;

- Outcome phase involving interpretation of the research findings.

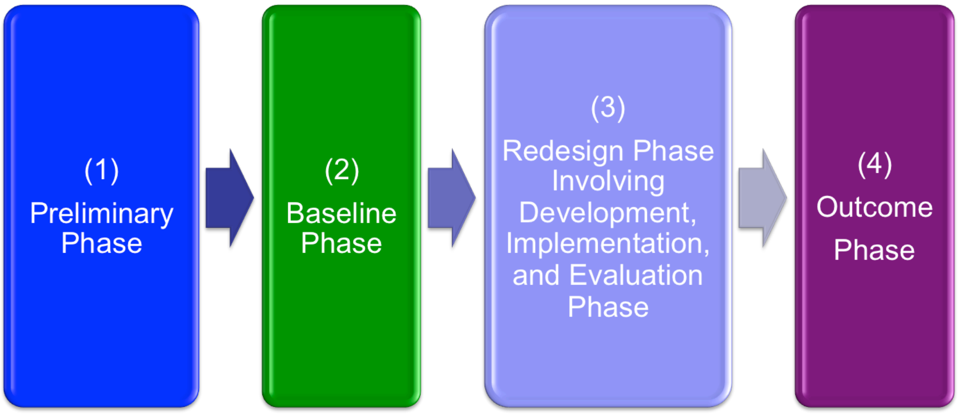


Figure 3.2 Four phases of research process

3.5.1 Mixed Method Approach with Quantitative and Qualitative

The primary purpose of quantitative method is to discover facts or knowledge that can be evidenced as being concluded in general. Quantitative method will reduce or curtail the phenomenon of reality in the form of variables that could measure numerical data. Quantitative researchers may use existing theories from the beginning of the study in order to define hypotheses with measured variable, and try to reduce the problem complexity in the form of questions or compact assumptions. Creswell (2003) presented that hypotheses come from concept theory and knowledge existing in the form of a deduction or inference (Deductive).

Qualitative researchers may invite each participant to share individual experience and exchange of their experiences and the meaning of their context. Qualitative researchers work as inductive or from the facts up, not from theory down that tends to be the case with quantitative research. Moreover, qualitative researchers prefer to present information in the form of non-numeric data, such as illustrations by text or image which depict the complexity and issues of human experience better than statistical analysis (Creswell 2003; Leedy & Ormrod 2005).

Mixed method is defined as 'research in which the investigator collects and analyses data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in single study or program of inquiry' (Tashakkori & Creswell 2007)

This research combined both quantitative and qualitative forms of inquiry into a 'concurrent triangulation' mixed-method design and both quantitative and qualitative data were collected and implemented to answer particular research questions (Leedy & Ormrod 2005; Teddlie & Tashakkori 2009). Concurrent triangulation mixed method design allowed researchers to triangulate results from separated quantitative and qualitative elements of the research, permitting them to confirm and cross-validate findings from a single study (Creswell, Plano Clark & Hanson 2003). Quantitative method by surveys including questions with a Likert-type is used to describe the incidence, frequency, and distribution of reliable characteristics of participants. Qualitative method by focus groups and semi-structured interviews is gathered relative to a single individual, or circumstance, for the objective of learning more about unknown or less understood situation. Each data set was analysed independently and the results of two studies were integrated by comparing and contrasting for constructing a new understanding how to improve students learning experience in online environment.

The purpose of this design is to obtain different data that was collected from three research stages. This approach obtains the result from two major sources: quantitative data and qualitative data to directly compare and contrast for confirmation and validation. It can be said that this approach is an equal weighting methodology designed to complement the strengths of one and reduce the weaknesses of the other.

Data collection and data analysis occurred in 3 stages, over 3 semesters, of the four phases of research process and included 196 students, 14 teaching staff, and 3 technologies within 3 educational units at the University of Tasmania. The research design consists of reviewing online unit, redesigning the online units, and evaluating staff and student response to the redesigned of the online units.

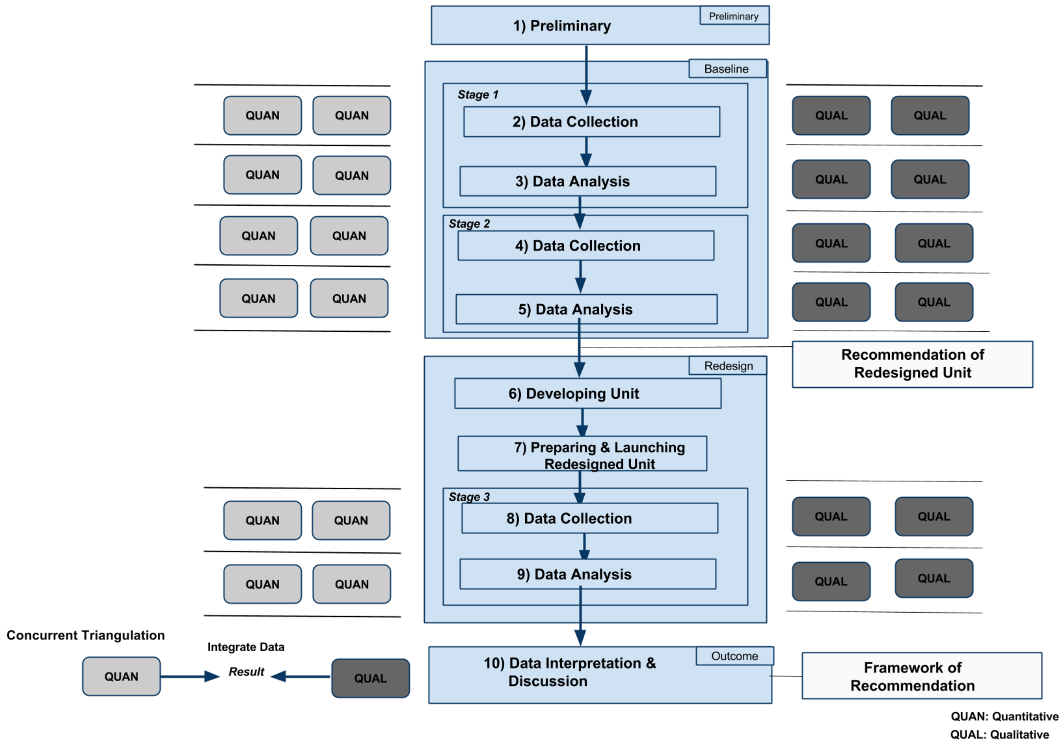


Figure 3.3 Diagram of research design including four phases of research process and mixed method with concurrent triangulation approach

An overview of the research design is presented in Figure 3.3. The following section will explore the four phases of research process in more detail.

3.5.2 Four phases of research process with stages of data collection and data analysis

The research has been planned and managed with four research phases: preliminary phase; baseline phase; trial, development, evaluation phase; and outcome phase. First of all, the student participants for each stage of data collection were different. Across the first three phases, data collection involved the use of both quantitative and qualitative techniques. Data analysis techniques included the use of social network analysis, descriptive statistics, factor analysis and thematic coding of the qualitative data from 3 focus groups and 14 semi-structured interviews. Following base-line analysis of two online units, re-design was conducted within the two online units and evaluation conducted within them.

From the academic calendar of the University of Tasmania, each semester consists of 13 weeks of study. The mid-semester break is held in week 6 or 7. The following table 3.3 shows the term/semester structure of the university over the two-year research period:

Table 3.3 The term/semester structure of the university over the two-year research period

Student group no.	Educational unit	Semester/ Year	Student participant	Number of work group	Number of assignments (a)	Assignment submission	Stage of data collection and data analysis
1	Unit one	2/2014	1st year undergraduate (26 students from the total of 55 enrolled students)	1	2	Week 5 (a1) & week 13 (a2)	Stage 1
2	Unit one	2/2015	1st year undergraduate (36 students from the total of 68 enrolled students)	1	2	Week 3 (a1) & week 11 (a2)	Stage 2
3	Unit two		3rd year undergraduate (25 students from the total of 45 enrolled students)	2	2	Week 3 (a1) & week 11 (a2)	
Developing redesigned unit							
4	Unit two (redesigned unit)	1/2016	3rd year undergraduate (64 students from the total of 110 enrolled students)	2	2	Week 3 (a1) & week 11 (a2)	Stage 3
5	Unit three (redesigned unit)		Master level postgraduate (45 students from the total of 50 enrolled students)	1	2	Week 3 (a1) & week 11 (a2)	

A total of ten steps are contained across the four phases. Each phase and associated steps are now explained:

3.5.2.1 Preliminary Phase – Phase One

Step one conducted from May-June 2014 involved preparing requirements, survey and interview questions that will be used in next phases. This phase involved requirement collection, ethics approval, clarifying baseline data, survey and interview initiation, and discussions with unit coordinators about setting up peer learning's groups, tasks, activities, marking and criteria. The data in this phase will lead into baseline phase; trial, development and evaluation phase; and outcome phase.

3.5.2.2 Baseline Phase – Phase Two

Step two of data collection in stage one conducted from July to October, 2014:involved collecting data using discussion board, survey, focus group, and conducting semi-structured interview.

Step three of data analysis in stage one conducted from November 2014 to July 2015 involved the analysis of the surveys using descriptive spreadsheet analysis while focus groups and interviews were analysed using thematic coding. The analysis of the surveys was conducted using factor analysis. Discussions on MyLO were analysed using social network analysis to show students' social network in discussion board.

Step four of data collection in stage two conducted from July to October 2015 involved collecting data using discussion board, survey, focus group, and semi-structured interview.

Step five of data analysis in stage two from August to November 2015 involved the analysis of the surveys using descriptive statistic while focus groups and interviews were analyzed using thematic coding. The analysis of the surveys was conducted using factor analysis and discussions on MyLO were analysed using social network analysis to show students' social network in discussion board.

In summary, step three and five collected data from discussion boards, surveys, focus groups. While the semi-structured interview data from step two and four delivers recommendations about peer learning, groups, tasks and activities in online environment.

3.5.2.3 Redesign Phase involving Development, Implementation and Evaluation – Phase Three

The research design utilised both qualitative and quantitative methods structured through a pre- and post- intervention approach over four phases supporting concurrent triangulation. The four phases were: a preliminary phase selecting and assessing units for the case study; a baseline phase involving data collection and analyses of existing unit delivery; a redesign phase involving development, implementation and evaluation phase targeting students learning experiences; and an outcome phase involving interpretation and discussion of the research findings. Across the first three phases data collection involved the use of both quantitative and qualitative techniques. Data analysis techniques included the use of social network analysis, descriptive statistics, factor analysis and thematic coding of the qualitative data from 3 focus groups and 14 semi-structured interviews. Following base-line analysis of two online units, re-design was conducted within the two online units and evaluation conducted within them.

Step six conducted from November 2015 to January 2016 included used baseline data from baseline phase including recommendation for the redesign of units. Theory and practical knowledge about expanded peer learning activities in online environment was supported together with unit coordinator's suggestions for improvement.

Step seven conducted from January to February 2016 provides guidance and handover of the redesigned unit with peer learning activities in online environment. Redesigned unit was launched in February 2016.

Step eight was conducted from February to May 2016 and involved collecting data by using discussion board, survey, focus group, and semi-structured interview.

Step nine was conducted from March to June 2016 and involved the analysis of the surveys using descriptive statistic while focus groups and interviews were analyzed using thematic coding. The analysis of the surveys used factor analysis and discussions on MyLO. Social network analysis was used to show students' social network in discussion boards.

3.5.2.4 Outcome Phase

Step ten was conducted from July to August 2016. This phase uses the result of all previous phases for data interpretation with concurrent triangulation and recommendations of proposed peer learning framework.

Section 3.5 has presented the research design while illustrating the four phases of the research process and why this approach was appropriate for this research. The next section presents the data collection tools and techniques.

3.6 Data Collection Tools

The data collection tools and techniques were used across the three stages (from four phases) of the research process. Three units were selected to be involved in this research including one 1st year undergraduate unit (62 students), one 3rd year undergraduate unit (89 students), and one postgraduate unit (45 students). Discussion boards and surveys were used for quantitative data collection from student participants. Focus groups and semi-structure interviews were used for qualitative data collection from the students and teaching team respectively. Student data was collected using an online survey and a discussion board, along with focus groups. Teaching team data was collected using semi-structured interviews. Especially for the discussion board, statistical data of student interaction was arrived at through a manual social network diagram.

Data was extracted from the discussion board of the University Learning Management System manually. This shows the relationship between students who post/ask and reply to each other. Researchers match students who interacted and draw social network diagrams including nodes of students working together with the number of threads, and replies, and read accordingly.

The researcher extracted manually student data from the discussion board of University Learning Management System. These data show who interacted by posting, asking and replying to each other. Matching between students' interaction is shown through a social network diagram that included node of students working together with number of threads, and replies, and read accordingly. Information from the interactions between students on the discussion board can be presented by showing the relationship within a social network. The bidirectional arrows are indicating that there are exchanges and mutual ideas. The unidirectional arrow means no mutual interaction between students has taken place.

The social network diagram was constructed from the data on student interaction gathered using the discussion board on the University Learning Management System, taking into account that different relationships influence different support (Carceller, Dawson & Lockyer 2015). The social network diagram shows the changing social relationships and connections between students over time for each unit (Carolan 2014). Each student was requested to post at least a few times during the weekly discussions to fulfill the course requirement for participation. Also, the posts were analysed as threaded discussions by students (Ruane & Lee 2016).

The social network diagram was created from the data of student interaction on the discussion board on LMS. The data were explored through drawing nodes (representing individual students) and links (representing interaction about the same topics of interest) to demonstrate the connections between members of the same social group. The diagram helps illustrate the changes in student interaction during the beginning of the semester in ‘week 3’ and at the end of the semester in ‘week 11’. It is also intended to show changes in social relationships or connections between actors over the semester (Carolan 2014).

To investigate the impacts of peer learning in an online environment it is essential to consider the changing students’ learning experience. Both students and teaching team are research participants. Student data was collected using online survey and discussion board along with focus groups. Teaching team data was collected using semi-structured interviews.

Information collected from both perspectives of teachers and students. One perspective comes from direct interview with teaching team who taught and supported students during whole semester. Another perspective of the students was collected from both survey and focus group, and complete information and insights from the learner's verbal feedback were presented as well.

The time period of each unit cover one semester. Figure 3.4 illustrates the methodological process of data collection adopted for this research.

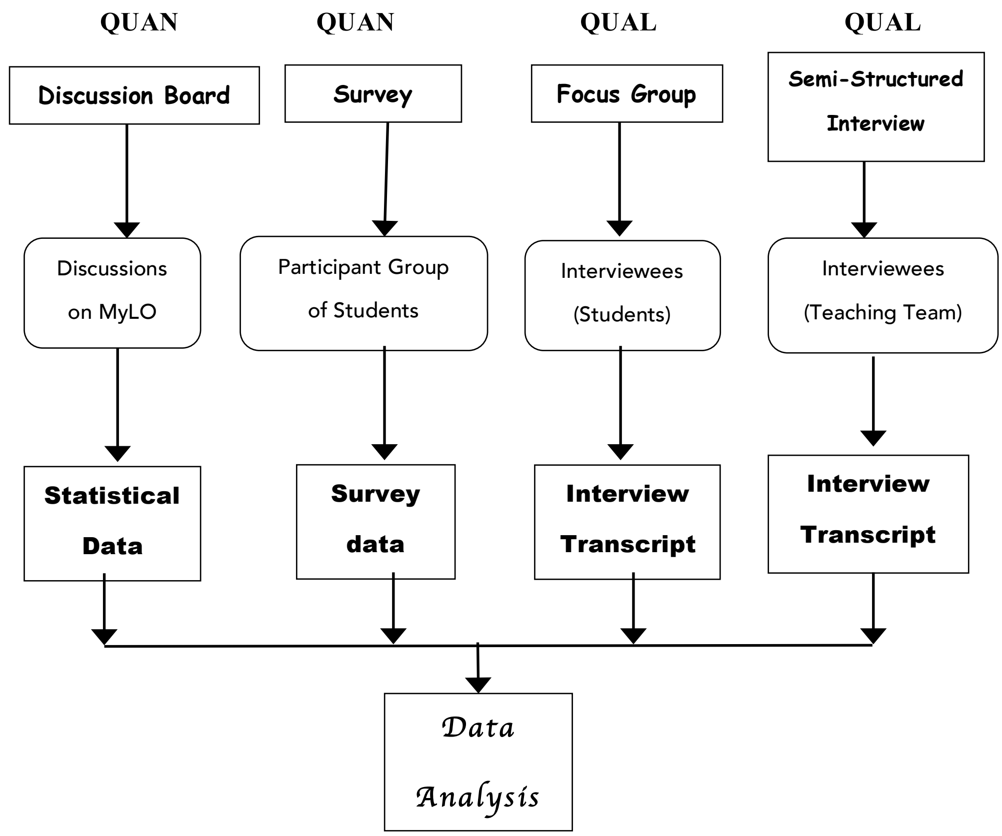


Figure 3.4 Data Collection Approach

The next section presents the ethics procedures for this research.

3.6.1 Ethics Procedures

Research is undertaken in the online environment that presents a number of challenges for researchers using it as a source of data collection.

The objective of ethics procedures is to ensure that the potential harm to research participants can be minimized. Each research participants are informed of their rights before the process of data collection. Research participants are as volunteers and were provided with consent forms and information sheet to ensure minimal misperception. The written ethical document was developed and approved inline with the requirements of Human Research Ethics Committee (Tasmania) Network (ethics reference number: H14198)

3.6.2 Participant Selection and Involvement Process

Participants included members of teaching team and students enrolled in identified units under study. The teaching teams were interested in peer learning and understood the concept and benefits that peer learning may bring. Moreover, teaching team used and encouraged their students to use peer learning in their online environment.

3.6.2.1 Selection of Participants

With the availability of teachers and teaching team combined with the design of peer learning, the main purpose of the three selected educational units is to encourage students to understand the importance of online peer learning and to develop their own learning experience continuously. All three units were selected based on same educational background (from the same faculty) with the comparison of different educational levels of study. Moreover, to confirm that peer learning is essential for both undergraduate and postgraduate studies. Three units, one 1st year undergraduate (87 students), one 3rd year undergraduate (64 students), and one postgraduate unit (45 students), were selected to be involved in this research. It was decided that approaching Unit Coordinators within the Faculty of Education would provide the best opportunity to recruit interested participants. Teaching teams from three units within the Faculty of Education (7 people from unit one, 4 people from unit two, and 3 people from unit three) agreed to participate in this research. Enrolled students in the three educational units were recruited as research participants. Students received the link of online surveys from Unit Coordinator and responded online surveys twice at beginning (1st online survey) and end of semester (2nd online survey) for comparison of changed learning experience. In addition, students who were interested and willing joined focus groups by invitation through by email at the end of 2nd online survey.

3.6.3 Quantitative data collection

Quantitative research focuses on the outcomes found through numerous cases, the logic is systematic with a linear path. It adheres to measure with numbers and use statistics for analyzing data (Neuman 2011). Quantitative research method are connected with the collection, analysis, interpretation, and demonstration of numerical information (Teddlie & Tashakkori 2009).

In quantitative research, the research questions are examined by verifying theory, the questions consist of variables that are defined by researcher. The researcher measures variables by using instrument to gain scores (Creswell 2009). Quantitative data sampling techniques are used for collecting numerical data that will now be presented.

3.6.3.1 Quantitative Data Sampling Techniques

Quantitative sampling techniques are used for precise representation of the numerical data according to specific research aims and research questions. There are two types of quantitative sampling techniques: probabilistic sampling and non-probabilistic samples (Kaplan & Duchon 1988; Neuman 2011). Non-probabilistic sampling does not use a randomized choosing process (Antonius 2003), probabilistic sampling is adopted for this research as it involves using a precise representative sample that has numerically predictable errors (Neuman 2011).

Probability sampling is based on sampling distributions. There are three basic types of probabilistic samples including simple random sample, stratified random sample, and cluster sample. Firstly, simple random sample is the most popular sampling technique. Each unit of population has equal opportunity to be in the sample. Secondly, stratified random sample needs the sample to be a delegate of population on a specific feature. Lastly, cluster sample is used by the researcher to create efficient sample groups (clusters) that appear naturally in the population (Teddlie & Tashakkori 2009).

Probabilistic cluster sample was adopted as the quantitative data sampling technique for this research. Students from three educational unit were selected as representative groups with unbiased data collection. Students participants voluntarily responded online survey and they were tracked their interaction in discussion board at the beginning and end of semester. Online survey and discussion board instruments established the validity and reliability of numeric results for serving useful objectives and outcomes (Creswell 2009).

The next sections present the quantitative data collection methods: discussion board and survey.

3.6.3.2 Discussion board

Discussion Board is a forum for supporting student engagement and peer interaction. It promotes mutual responsibility and shares resources with group members (Moule 2006; Revere & Kovach 2011).

Discussion Boards were used to investigate the relationship between students within a unit of study. The discussion boards were housed on MyLO (the University's Learning Management System) and provided data that represents students' interactions. The Discussion Boards were integrated into the units and their use changed over the course of the study.

3.6.3.3 Survey

Survey gives a quantitative numerical data by investigating a sample of population (Creswell 2009). Surveys will create both questions and rating scales for serving research objectives (Leedy & Ormrod 2005). Surveys involve information acquisition of one or groups of people including their experiences, attitudes, ideas, attributes and behaviours. It asks people by questions and consolidates their answers as descriptive information.

The survey consists of learning experience questionnaire (see Appendix A) is adapted from The Constructivist OnLine Learning Environment Survey (COLLES). which contains seven parts including:

- relevance,
- reflection,
- interaction,
- teacher support,
- peer support,
- making sense, and
- course technology.

The survey for end of semester is different from the survey for beginning of semester by asking both preference ('I prefer that') and feedback ('I found that'). In addition, this study used 32 closed questions with using a 5-point Likert scale, from 'Almost always' to 'Almost Never', to rate the influencing of each item on students learning experience in online environment.

The researcher poses a series of questions through the online survey tool 'SurveyMonkey' to willing student participants of their changed learning experience at the beginning and end of three semesters. 196 total responses were received.

3.6.4 Qualitative data collection

Qualitative methods are designed to support understanding people and the social circumstance within which they are (Avison & Myers 2002). This method consists of different approaches for collecting, analysing and interpreting qualitative data.

A qualitative method does not change all perception into numbers and qualitative data is massive, nonstandard, and different (Bryman 2015; Denzin & Lincoln 2000). Qualitative research is an approach to investigate that starts with the study of research problems exploring the meaning individual or group attribute to a social or human problem together with understanding the context of research participants. Data is collected in natural settings of people under study and the data analysed by grouping information into summary codes, open codes and to finally produce themes (Creswell 2007).

Qualitative method is used because quantitative method does not capture the uniqueness of individuals and quantitative measures are not sensitive to issues of individual differences (Creswell 2013). Interviews were used to present the views of participants with effective interpretations (Walsham 1995). Focus group and semi-structure interviews were the data collection methods adopted.

3.6.4.1 Focus group

Focus group is a group of research participants informally "interviewed" in discussion surroundings and focused on a specific topic. Focus group allowed the interaction in a group discussion as a source of collected data (Billson 1989; Morgan 1996; Neuman 2011).

The questions for focus group were framed into seven broad discussion topics to investigate deeper the influencing of each item on students learning experience in online environment from student perspectives. The seven discussion topics were:

- Relevance: What aspects of this unit did you find most relevant to you and your future employment goals?
- Reflection: How did the activities within this unit allow you to think more critically about your ideas and those of your peers?
- Interaction: How do you feel about the way you were asked to interact with your peers in this unit?
- Teacher support: What do you think about the way the teaching team encouraged you to participate with content and your peers in this unit?
- Peer support: What do you think about how your peers interacted with you in this unit?
- Making sense: What do you think about the way you were asked to communicate with the teaching team and your peers in this unit?
- Course technology: What do you think about the technology used within this unit to facilitate engagement with the content and your peers?

Student participants were invited to an online focus group session through the 'Blackboard Collaborate' web conference application that was conducted during the last week of semester. During focus group, participants showed their willingness to share their own ideas and beliefs. The focus group data was recorded by the application for later transcription. From the three semesters involved in the data collection, there were 3 focus groups with 7 total participants involved (3 people from 1st focus group, 2 people from 2nd focus group, and 2 people from 3rd focus group). The researcher did not contact student participants directly. However, those voluntary participants willingly participated in the focus group and provided information about their changed learning experience. Although the number of students joining the focus group is small, these are voluntary participants who are not rewarded or coerced in any way. Thus, making their information is a valuable and useful insight into their learning experience that is directly relevant to the individual students. It can be seen that the data collected for this research involve multiple sources as a means of confirming the results of the research received from both the learner and the teacher perspectives.

3.6.4.2 Semi-Structured Interview

The interview is data collection approach using conversation style approach between researcher and participants (teaching team). Key aspects of the interview include researcher defining content and structure of the discussion and the interview questions that are related to the research topics and research questions (McLellan, MacQueen & Neidig 2003).

Particularly, individual interviews are suitable to get deep social and personal information. The questions of interviews were outline and flexible with the brief questions to guide an interview or conversation to complete the research objectives. Furthermore, research questions were enough for participants' sharing experiences related to research topic and research objectives (DiCicco ‐ Bloom & Crabtree 2006).

The researcher shared with the participants at the beginning of the research the research's objective. It is important that the interviews were successful by making participants more comfortable with faithful reaction (Walsham 2006). To that end the interviews were conducted with the participants in their own offices.

Semi-structured interview was planned and interview questions were loosely structured structure. The questions for interviews were framed into seven broad discussion topics to investigate deeper the influencing of each item on students learning experience in online environment from teaching team perspectives. The seven questions were:

- Relevance: What is the relevance of online learning (processes/activities) on students in online environment?
- Reflection: What is the impact of online learning (processes/activities on students' critical reflective thinking in online environment?
- Interaction: What is the nature of student interaction in online environment?
- Teacher support: How do you support students' interaction both individually and peer group learning in online environment?

- Peer support: How do students support one another in online environment?

- Making sense:
    - How about the effectiveness of teacher and students communicate with each other in online environment?
    - How about the effectiveness of students and students communicate with each other in online environment?

- Course technology:
    - What is the technology that you use to support students' participation in online learning?
    - Would you like to have additional technologies? Why?

The interviews were carried out with the participants using video and voice services (Skype or Lync relied on participants) at the beginning of 3 semesters. There were 14 individual total interviews with teaching teams with an average duration of 30 minutes. The interviews were audio recorded by using Quicktime application for further transcription.Researcher also followed the seven guidelines for conducting qualitative interview consist of 1) situating the researcher as actor, 2) minimise social dissonance, 3) represent various voices, 4) everyone is an interpreter, 5) use mirroring in Q & A, 6) flexibility, and 7) confidentiality of disclosures (Myers & Newman 2007).

Section 3.6 has presented the research techniques used in data collection which supported the research strategy (see section 3.4) and informed the research design (see section 3.5). The next section presents the methods used in the analysis of the data collected for the research.

3.7 Data Analysis

This section of the research methodology examines the approaches that were used to analyse the collected data of discussion board, survey, focus group, and semi-structured interview. The data analysis consists of four different analysis approaches: social network analysis from the discussion board data on MyLO, descriptive spreadsheet analysis and factor analysis generated from the survey data, and thematic coding from the interview data of focus group and semi-structure interview . The diagram in Figure 3.5 illustrates the analysis approaches that were used for this research. The detail of quantitative data analysis and qualitative data analysis are shown in the following sections.

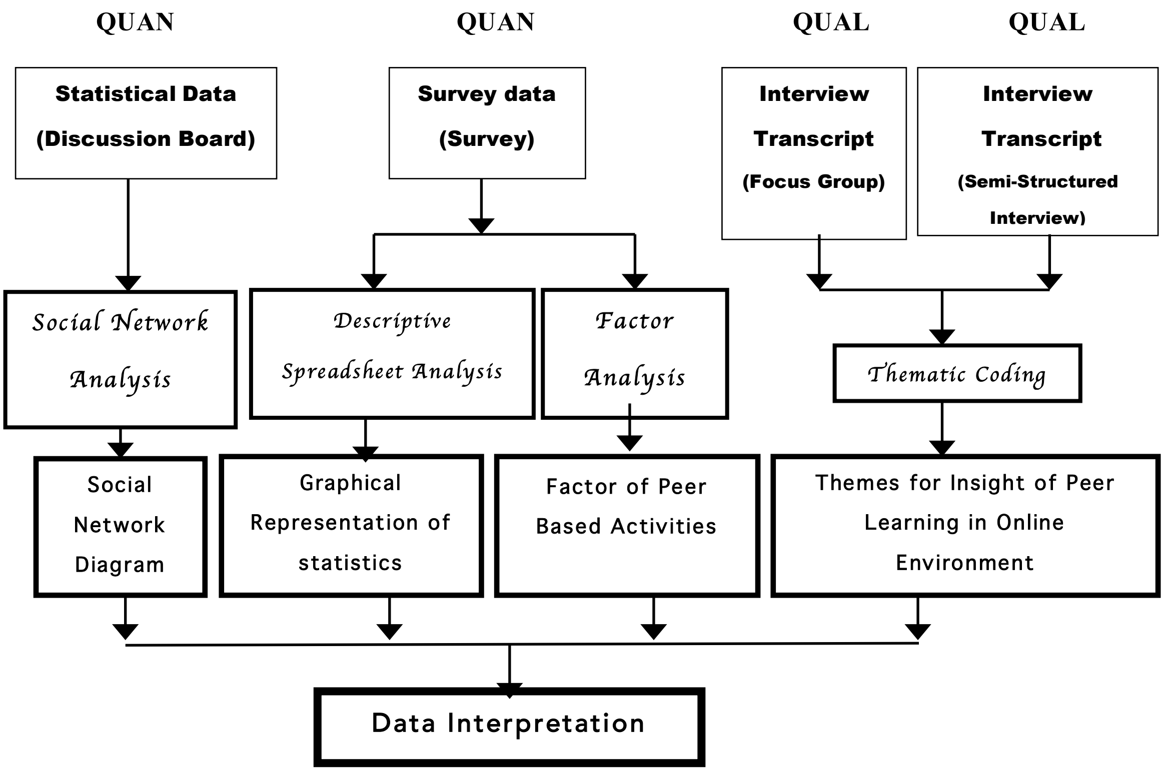


Figure 3.5 Data Analysis Approach

The next section presents the quantitative data analysis for the research.

3.7.1 Quantitative Data Analysis

Collected quantitative data are in the form of numbers. The numbers are presented the values of variables that estimate the characteristics of research participants (Kaplan & Duchon 1988). The number data will be shown as social network diagrams, graphical representation of statistics, and factor analysis of the peer-based activities.

The next sections present social network analysis, descriptive spreadsheet analysis, and factor analysis that were used for quantitative data analysis.

3.7.1.1 Social Network Analysis

The social network analysis concentrates on the type of relations between members or actors and how individual and group behaviour and/or attitudes are influenced by these relations (Carolan 2014). The interaction from network of connections represents the social relations or community structure including frequency of friendship among pair members (Scott 2012).

Social network can model the changes of peer relationship and interaction (Grunspan, Wiggins & Goodreau 2014; Sentse et al. 2014). Students' social connections can be investigated from online discussion board of learning management system (LMS) and different relationships influence different support (Carceller, Dawson & Lockyer 2015). The changeable interaction of student or member of social group during the considerable period has to be presented. Also, social network can represent the relationship or interaction among members of social group (Wenger, Trayner & de Laat 2011b).

The social network diagram was created from the data of students' interaction gathered using the discussion board on MyLO. This data are explored through drawing nodes (individual students) and links (interaction with same topics of interest) for demonstration the connections between each member of social group. It shows the changes of students' interaction between beginning of semester in 'week 3' and end of semester in 'week 11'. The social network diagram had been created to show the changing of social relationship or connection between actors over that time of the unit (Carolan 2014). (See the example of social network diagram between week 3 and week 11 in figure 3.6).

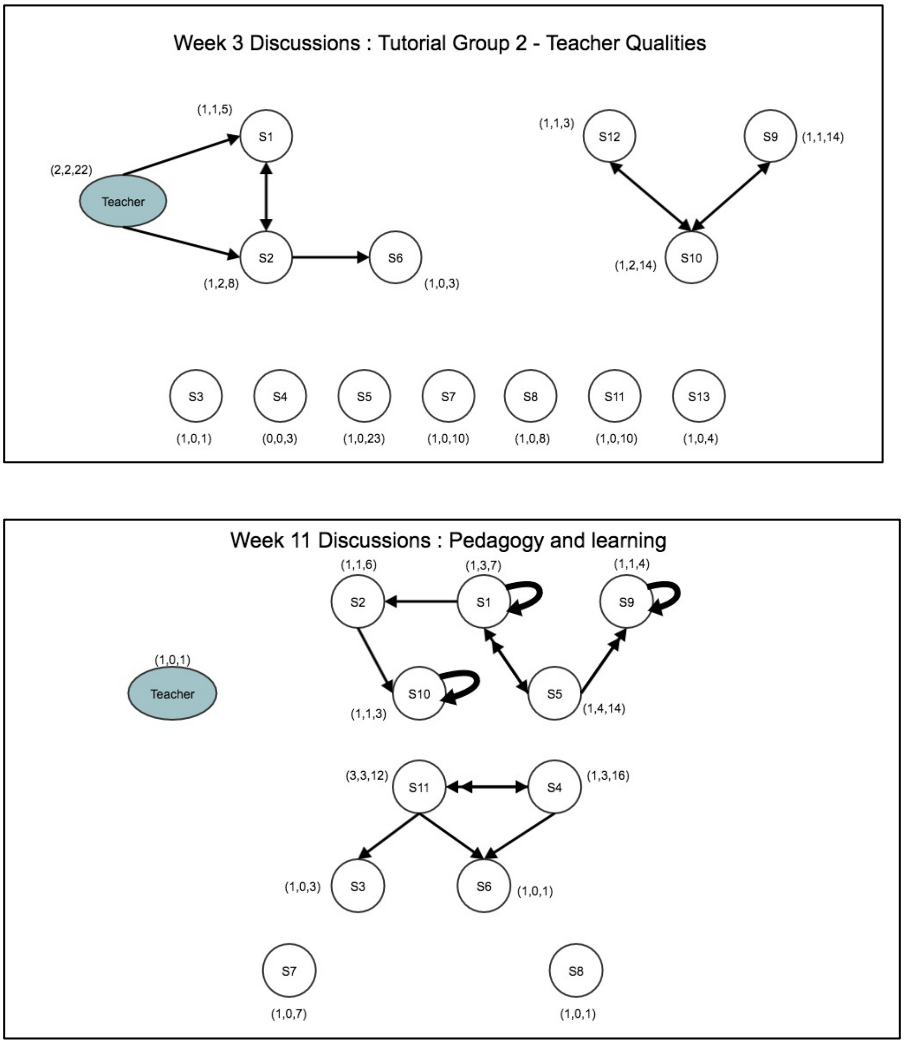


Figure 3.6 Example of social network diagram

From figure 3.6, the diagram is showing that (x,y,z) means (number of Threads, number of Replies, number of Read (including own)); xx means N/A; Sx means Students; arrow is shown the direction of reply; and number of arrow is shown number of reply.

3.7.1.2 Descriptive Analysis

The numeric data was initially analysed by showing the answer of students on worksheet then produce the bar and pie charts. Preparatory survey data analysis normally connects 'descriptive statistics' that can be classified according to number of used variables (Creswell 2003). Seven parts from online survey was analysed in order to gain an understanding the students learning experiences in beginning and end of semester.

The analysis was supported by employing Statistical Package for the Social Sciences (SPSS) in order to do factor analysis and using Microsoft Excel Spreadsheet Software Program in order to do descriptive spreadsheet analysis.

Descriptive analysis was demonstrated by bar and pie graphs that covered interpreting data with view of displaying conclusions about research questions. Figure 3.7. is an example of the graphical representation of statistics from descriptive analysis.

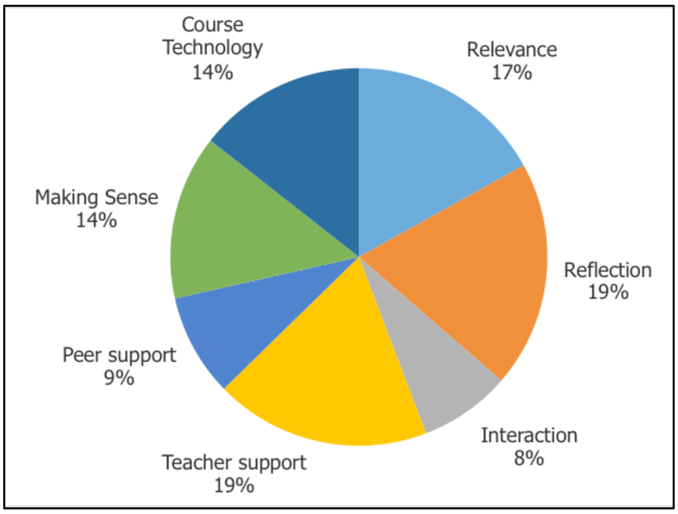


Figure 3.7 Example of graphical representation of statistics

3.7.1.3 Factor Analysis

Factor analysis is a multivariate statistical method which will be used for quantitative survey data to describe variability among correlated variables in terms of factors including identifying complex interrelationships among items and group items (Newsom 2005; Williams, Onsman & Brown 2010). The dependence is the statistical relationship between two variables/factors and dependent variables/factors are measured by doing correlation. The purpose of doing correlation is describing the degree of relationship between two variables/factors. Higher scores on one variable/factor conduce to be paired with higher scores on the other and that lower scores on one variable/factor conduce to be paired with lower scores on the other.

The purpose of factor analysis is to determine the number of factors to be retained in the all item sub-categories (Zakariya 2017). It can also aid in broadening psychological processes, to assess validity evidence for using particular scales (Flora

& Flake 2017). According to the results from the integration of both quantitative and qualitative data analysis, especially factor analysis (one part of quantitative data analysis) offers the data to be explored for potential relationships from which a theory could be made and part of the exploration by factor-analytic procedures for further answering the research questions (Gorsuch 2015).

Factor analysis is a data reduction method for reducing a large number of variables to a smaller group of essential factors that sum up the crucial information held in the variables (Coakes & Steed 2010).

Factor analysis has two statistical approaches to investigate the reliability of measurement: Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA). Confirmatory factor analysis (CFA) needs specific factor structure be determined that research has to show which items load on which factor. The researcher is able to indicate correlated measurement errors and execute statistical comparisons of alternative pattern (Ho 2000). Exploratory Factor Analysis (EFA) allows the researcher to explore and originate model from an associated large set of potential set of items (Ho 2000; Williams, Onsman & Brown 2010). Using EFA, researcher determines on the number of factors by investigating output from a principal components analysis with eigenvalues (Newsom 2005).

Multivariate Factor Analysis is conducted in order to expose the hidden structure within a dataset of variables. The analysis reduces attribute space from an initial larger number of variables down to a smaller number of factors. This analytical process is termed a "non-dependent" procedure, that is, it does not assume or use a specified dependent variable, but reuses each variable within the dataset when conducting the analysis.

This research extends the Constructivist On-Line Learning Environment Survey (COLLES) instrument which presented six pre-determined scales: Relevance, Reflection, Interactivity, Teacher support, Peer support & Interpretation. Therefore it was considered appropriate that factor analysis be considered in order to investigate these scales further as part of gaining understanding of student capacity, the impact of peer learning and the effect of technology in an online environment.

The literature reveals multiple recommendations governing the conduct of factor analysis. Suggested minimums for sample size include from three to twenty times the number of variables and absolute ranges, from one hundred to one thousand. There is little empirical evidence to support any of these recommendations. A common level of agreement seems to settle on a minimum of 100 data items per analysis but no maximum (Antonius 2003; Ho 2000; Leech, Barrett & Morgan 2013). This study's analysis included 875 data items within the smallest analysis conducted (25 students) and 2240 data items (64 students) within the largest analysis conducted. The number of data items for analysis fell well within the accepted boundaries for factor analysis.

Factor analysis has two statistical approaches to investigate the reliability of measurement: Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA).

Confirmatory Factor Analysis (CFA) allows the researcher to explore and generate models from an associated large set of potential items (Ho 2000; Williams, Onsman & Brown 2010). In this case, within the largest data set, 2240 data items were collected. Using CFA, a researcher can determine and then compare the number of identifiable factors by investigating output from a principal components analysis with Eigen values greater than 1.0 (Newsom 2005). The CFA analysis was conducted on data harvested using the amended COLLES instrument. This was essential to ensure that the added questions still maintained the integrity of the original instrument but also allowed for extension into the new areas of investigation. The CFA results confirmed that the identified factor structure observed after analysis by using the newly amended survey artefact did produce a similar factor structure when compared with the results from the original COLLES instrument.

In the original COLLES study, subset groupings were applied before factor analysing the data. It was decided to address the concerns expressed within the literature from other noted researchers about pre-defining the subsets prior to analysis. As Ho (2000) states, "it is not uncommon for a dataset to be subjected to a series of exploratory factor analysis and rotation before the obtained factors can be considered clean and interpretable".

Ho (2000) explains, "Exploratory Factor Analysis (EFA) seeks to uncover the underlying structure of a relatively large set of variables. The researcher's a priori assumption is that any indicator may be associated with any factor. This is the most common form of factor analysis. There is often no prior theory and one uses factor loadings to intuit the factor structure of the data" (Antonius 2003; Ho 2000).

From the results of the CFA it was apparent that the new survey instrument would produce a structured form of output that was similar to the original COLLES instrument. However the introduction of additional questions and using the new survey instrument across very different student cohorts might reveal as yet undiscovered groupings of factors.

Having now completed a confirmatory analysis using a purposively constructed instrument that has demonstrated, the capacity to analyse and produce structured factors as maintained by a cohort of participants, the next logical step was to attempt to provide further extrapolations and comparisons by using the new instrument and conducting an Exploratory Factor Analysis (EFA).

Subsequently, the original dataset was for further analysed using the multivariate factor analysis methodology developed over the course of this research. This new phase of the project would use the naturally forming underlying subsets found in the data.

As discussed in Chapter 3 (see section 3.7.1.3) Exploratory Factor Analysis required the researcher to make various decisions, each of which influenced the solutions being generated (Gaskin & Happell 2014). In addition, EFA was able to differentiate between major factors (high correlation) and minor factors (low correlation) (Hayton, Allen & Scarpello 2004). The sample size was qualified from the strength of factors and the items (Beavers et al. 2013).

Exploratory Factor Analysis (EFA) allows the researcher to explore and generate models from an associated large set of potential items (Ho 2000; Williams, Onsman & Brown 2010). Using EFA, a researcher determines the number of factors by investigating output from a principal components analysis with eigen values (Newsom 2005). EFA requires researcher to make various decisions, each of which influences the solutions generated (Gaskin & Happell 2014). In addition, EFA is able to differentiate between major factors (high correlation) and minor factors (low correlation) (Hayton, Allen & Scarpello 2004) in data sets. The sample size is qualified from the strength of factors and the items (Beavers et al. 2013). Moreover, the number of student respondents per item is shown in the appendices as follows:

Appendix F Quantitative data analysis (stage one unit one – 26 participants for 1st survey & 24 participants for 2nd survey);

Appendix G Quantitative data analysis (stage two unit one – 36 participants for 1st survey & 12 participants for 2nd survey; stage two unit two – 25 participants for 1st survey & N/A for 2nd survey),

Appendix H Quantitative data analysis (stage three unit two – 62 participants for 1st survey & 28 participants for 2nd survey; stage three unit three – 21 participants for 1st survey & 11 participants for 2nd survey).

The steps of Exploratory Factor Analysis (Williams et al., 2010) is now presented.

Calculation of the Correlation Matrix

With inspection the correlation matrix (see table 3.4) for correlation coefficients over 0.30 (not low correlation) for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Table 3.4: Example of correlation matrix

Correlations

		S1F1	S1F2	S1F3	S1F4	S1F5	S1F6
S1F1	Pearson Correlation	1	.332*	.408*	.527**	.464**	.570**
	Sig. (2-tailed)		.048	.014	.001	.004	.000
	N	36	36	36	36	36	36
S1F2	Pearson Correlation	.332*	1	.312	.463**	.430**	.317
	Sig. (2-tailed)	.048		.064	.004	.009	.060
	N	36	36	36	36	36	36
S1F3	Pearson Correlation	.408*	.312	1	.219	.521**	.631**
	Sig. (2-tailed)	.014	.064		.200	.001	.000
	N	36	36	36	36	36	36

Correlations

		S1F1	S1F2	S1F3	S1F4	S1F5	S1F6
S1F4	Pearson Correlation	.527**	.463**	.219	1	.270	.335*
	Sig. (2-tailed)	.001	.004	.200		.111	.046
	N	36	36	36	36	36	36
S1F5	Pearson Correlation	.464**	.430**	.521**	.270	1	.639**
	Sig. (2-tailed)	.004	.009	.001	.111		.000
	N	36	36	36	36	36	36
S1F6	Pearson Correlation	.570**	.317	.631**	.335*	.639**	1
	Sig. (2-tailed)	.000	.060	.000	.046	.000	
	N	36	36	36	36	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

From table 3.4, there are 6 significant factors that have their correlation coefficients over 0.30 for factor analysis. For example, correlation of factor F1, F2, F3, F4, F5, and F6 on first row are 1, .332, .408, .527, .464, and .570 respectively.

Methods of Extraction of Initial Factors

Exploratory Factor Analysis (EFA) was conducted, with **principal component analysis (PCA)** as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Table 3.5: Example of eigenvalue

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	**11.740**	36.688	36.688	11.740	36.688	36.688	5.742
2	**4.153**	12.979	49.667	4.153	12.979	49.667	4.655
3	**3.388**	10.587	60.254	3.388	10.587	60.254	4.306
4	**2.335**	7.298	67.552	2.335	7.298	67.552	4.051
5	**1.912**	5.976	73.528	1.912	5.976	73.528	3.278
6	**1.193**	3.728	77.255	1.193	3.728	77.255	2.690
7 …	.988 …	3.086 …	80.342 …				
32	.001	.003	100.000				

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including

- ***Kaiser's criteria*** (eigenvalue >= 1, see blue highlighted in table 3.5). The particular factors will be extracted and hold for interpretation. In table 3.5, there are six factors produced by conducting factor analysis.

- Cumulative percent of variance is also extracted (see green highlighted in table 3.5). For example, Factor 1 has cumulative % 36.688

Scree plot

The scree plot shows the number of extracted factors. In figure 3.8, six factors are shown according to their eigenvalue. Following principal component analysis (PCA) with Kaiser's criteria, factor extraction was determined by having an eigenvalue > 1 (see table 3.5) (Williams, Onsman & Brown 2010). Above the red line (eigenvalue cut-off as inflection point), six significant factors with eigenvalue > 1 (left of the inflection point) are presented (see black arrows). Again, the six points which were selected according to factors are displayed in their order of extraction (on the X axis). The initial factors extracted are large factors (with high eigenvalues), followed by smaller factors. Graphically, the plot will show an abrupt slope between the larger factors and a more gradual sloping as the remaining factor loadings level out. The point at which the curve first begins to straighten out is considered indicative of the maximum number of factors to extract. That is, those factors above this point of inflection are deemed meaningful and those below are not (Ho 2000).

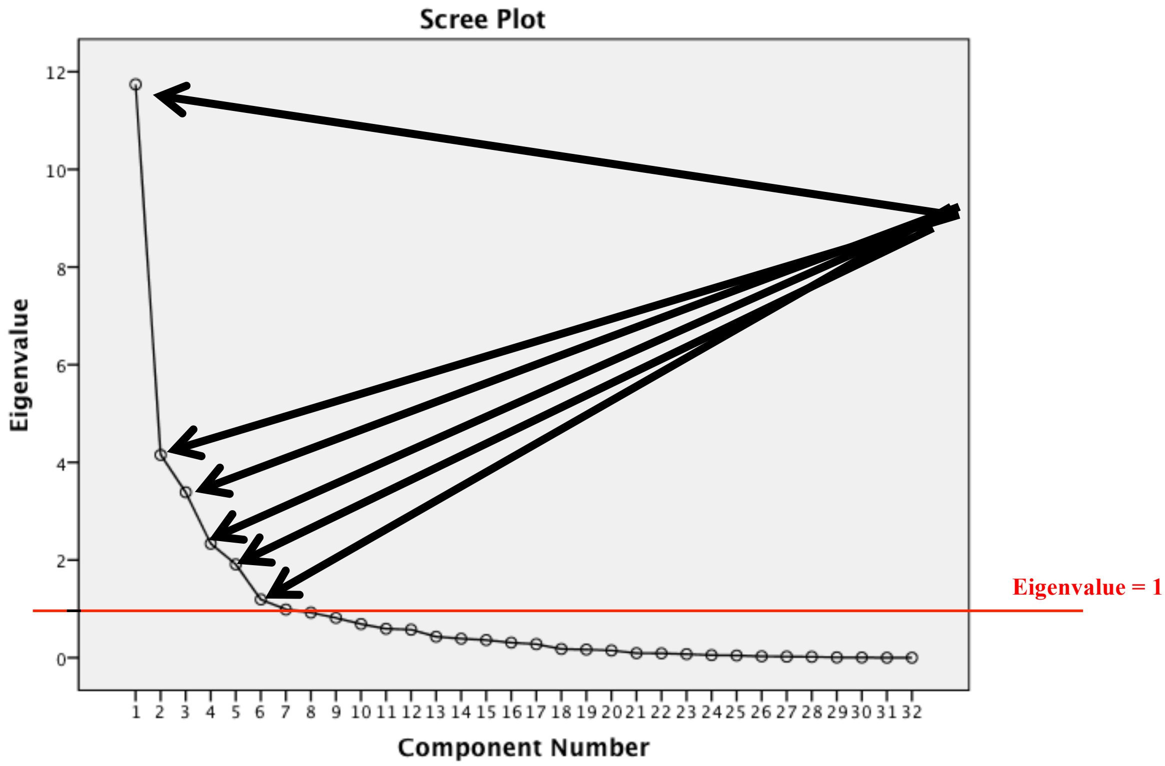


Figure 3.8 Example of Scree Plot

Originally attributed to Guttman in 1954, this criterion is commonly connected to Kaiser's (1960) study in which it was a critical component. The K1 rule suggests a heuristic rule for discarding the least important factor loadings from the overall analysis. This rule (K1) advocates the dropping of all those components with eigenvalues less than a value of 1.0. While this heuristic rule may overestimate or underestimate, in some cases, the true number of factors, the prevalence of simulation study data suggests it is a conservative criterion which usually overestimates the true number of factors within the analysis (Lance et al., 2006).

The Kaiser criterion is currently the default method employed within the SPSS application, along with most other statistically based computer programs/equations, but it is not really recommended when used as the sole cut-off criterion for calculating the number of factors required to be produced by the analysis process.

The justification for considering and using the Kaiser criterion is that the amount of common variance explained by the extracted factors should be at least equal to the variance explained by a single variable (unique variance), if that factor is to be retained for interpretation. An eigenvalue greater than or equal to 1.0 indicates that more common variance than unique variance is explained by that particular factor (Antonius 2003; Ho 2000).

Factors are displayed in their order of extraction (on the X axis). The initial factors extracted are large factors (with high eigenvalues), followed by smaller factors. Graphically, the plot will show a abrupt slope between the larger factors and a more gradual sloping as the remaining factor loadings tend to level out (See Figure 3.8: Example of Scree Plot). The point at which the curve first begins to straighten out is considered indicative of the maximum number of factors to extract. That is, those factors above this point of inflection are deemed meaningful and those below are not (Ho 2000).

In Figure 3.8: Example of a scree plot, there can be seen a clear demarcation between the six significant factors of shared common variance and a value exceeding 1.0 (indicated in bold type with a greyed background) and the remaining factors.

Rotation of the Extracted Factors

Rotation maximizes the high item loadings and minimizes low item loading. This research uses ***orthogonal varimax*** rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness as the effect of making the factor loading pattern much clearer (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Interpreting Factors

The interpretation of factors was undertaken in the research by examining which variables are attributable to a factor, and then presenting the name or theme to the factors (see table 3.6). For example, F2 is a factor that was from the 6 questions of online survey (question no. 29, 28, 31, 27, 32 and 30: sequenced by the loading value).

Table 3.6: Example of interpreting factors

Factor no.	Name or theme of factor	List of questions	Information
F1	Critical thinking	4, 3, 8, 10, 6, 2, 1, 12, 5, 9, 7, 11, 16, 15, and 13	Personal reflection for being able to think critically requires the development of professional practice. Each student must be responsible for interacting with others together with understanding the ideas of self and others.
F2	Supportive technology	29, 28, 31, 27, 32, and 30	Technology is used for supporting students' learning by encouraging students' participation and improving learning activities. This is in order to develop students' learning experience. However, students and teacher also make good sense of their message with each other.

From figure 3.9, the number of correlation between two factors is shown the strength of relationship. The arrow is also presented the direction of interaction. For example, between F2 and F3 has one-way interaction that means F2 influenced to F3. Also, between F1 and F5 has two-ways interaction that means F1 and F5 influenced with each other. In addition, the strongest relationship is between F1 and F5 while the relationship between F3 and F5 was stronger than F4 and F5, F2 and F3, and F4 and F6 respectively.

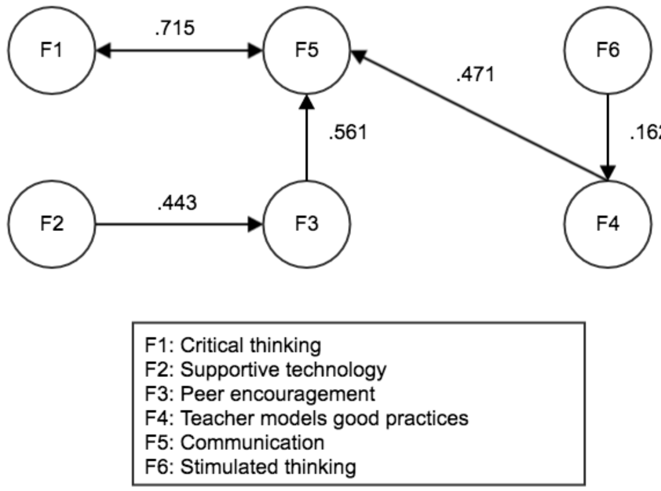


Figure 3.9 Example of interpreting factors

Adopted Factor Extraction

Exploratory factor analysis (EFA) is used to encounter the factor structure of measurement with inside reliability. EFA was selected because of not having hypotheses for factor measurement and it allow all items loading all factors. The factors were extracted by using principal component analysis (PCA) with orthogonal varimax rotational technique for factor representations.

Section 3.7.1 has presented the quantitative data analysis for the research. The next section presents the qualitative data analysis for the research.

3.7.2 Qualitative Data Analysis

Qualitative data analysis relates to text-based data during qualitative investigation (Myers 1997) and it requires specific concentration to how scriptural data, especially transcripts of recorded, are provided (McLellan, MacQueen & Neidig 2003). The focus group and interview data, after transcript of recording, was analysed immediately. The researcher read the transcripts several times before undertaking the process of coding. The transcript is one tool for helping qualitative research to understand participants' experiences and perceptions (McLellan, MacQueen & Neidig 2003).

Generally, researcher conducting qualitative data analysis are guided by the following steps:

1) transcript of recording
2) managing information by topic or issue
3) managing informants' information line by line and enter sequence number for easy analysis
4) writing and transcript of the response of the informants
5) describing the transcription
6) Creating Category
7) summary for each category or from each interview
8) comparing information from different sources
9) checking data for reliability and honest by informants
10) Updating information.

Table 3.7: Steps of conducting qualitative analysis

Transcript of recording	**Line no.**	**Separated lines of transcript**
Peer support 2,6,7		**Approved** ☑Yes ☐No 4,8 Comment ……………
What do you think about how your peers interact with you in this unit?	L1	Initially it was quite good because interactions is what we were basing that first assessment task on.
L1) Initially it was quite good because interactions is what we were basing that first assessment task on. L2) And once it become not part of the assessment task it was very few people interacted. L3) and it was actually just before our research proposal was due.	L2	And once it become not part of the assessment task it was very few people interacted.
	L3	and it was actually just before our research proposal was due.

The researcher also noted the possible processes of case study for determining the reliability, for example, checking transcripts not including obvious mistakes during the transcription (Burnard 1991; McLellan, MacQueen & Neidig 2003). To this end as English is my second language the transcripts were prepared from the recordings by a native English speaker.

Myers (1997) claimed that modes of analysis (including hermeneutics, semiotics, and narrative and metaphor) is used for data analysis especially in qualitative method because it can consist of different approaches to collecting, analysing and interpreting qualitative data. The approaches of qualitative data analysis are related to text-based data and they depend on the basic of epistemological assumptions during qualitative investigation. The qualitative data in this research has been analysed using Thematic Analysis based on Open Coding from Grounded Theory.

The next section presents thematic coding was used for qualitative data analysis.

3.7.2.1 Thematic Coding

Thematic coding is used for interpretation procedures along with evaluated criteria. Its procedures are built to improve a well-joined group of concepts that prepare description of social information under study. Level of foretelling is shown depend on definite conditions (Corbin & Strauss 1990).

Focus group and Interview data was analysed by using 'Thematic Coding' drawing on principles from Grounded Theory (Braun & Clarke 2006). The themes created are grounded in the data and will draw upon techniques (Corbin & Strauss 2008; Corbin & Strauss 1990). Thematic coding is similar to Grounded Theory (Rice & Ezzy 1999) and can produce themes for further applying to the data (Corbin & Strauss 2008). In addition, open coding in Grounded Theory supports the production of themes (Corbin & Strauss 1990).

The process of "Thematic Coding" is firstly presented with the development of the summary codes, open codes and then themes that will be explored further.

3.7.2.1.1 Summary Coding

A summary code based on data reduction process and this coding process was generally to gather insights from large amounts of data by compressing large volumes to manageable pieces (Miles & Huberman 1994).

The summary coding was developed to ensure that the result of data analysis was connected to the raw data. The summary codes are significant linked to the data with the description of a sentence level (Urquhart 2000). The summary codes of the interview were the first step of removing the data from the interview transcripts. Excel was used to support the coding process. The summary codes were referenced to the interview transcripts by their own line numbers in an Excel worksheet. 17 number of interviews resulted in 7258 number of summary codes.

Example of transcript to summary code is in table 3.8

Table 3.8: Example of raw transcript to summary codes

Raw transcript	Separated lines of transcript	Summary codes
What do you think about how your peers interact with you in this unit?	L1) Initially it was quite good because interactions is what we were basing that first assessment task on.	Good peers interaction based on first assessment task (SC1)
L1) Initially it was quite good because interactions is what we were basing that first assessment task on. L2) And once it become not part of the assessment task it was very few people interacted. L3) and it was actually just before our research proposal was due.	L2) And once it become not part of the assessment task it was very few people interacted.	Few peers interaction as not part of assessment task (SC2)
	L3) and it was actually just before our research proposal was due.	Few peers interaction before due date of students' research proposal (SC3)

The summary coding is followed with the open coding that will be explored further.

3.7.2.1.2 Open Coding

'Coding' is basic analytical process. Especially, open Coding is the meaningful process that data is condensed into categories (Braun & Clarke 2006). Thoughtful open codes are formed and same events are combined together (Corbin & Strauss 1990).

'Open coding is the analytic process through which concepts are identified and their properties and dimensions are discovered in data'. The open codes were represented major idea of summary codes line by line analysis (Corbin & Strauss 2015).

Open coding is not a singular process, to ensure meaning is not lost a number of iterations of open coding were conducted.

Example of open coding is in table 3.9

Each iteration saw the duplicated open codes removed with the refined list of codes copied to a new Excel worksheet. The process of categorising continued until no new categories were discovered. 2103 open codes were produced in stage one, 3246 in stage two, and 1173 in stage three.

Table 3.9: Example of open coding

Summary codes	Open codes	Deleted duplicate open codes
Good peers interaction based on first assessment task *(SC1)*	Peer interaction based on assessment task *(OC1)*	Peer interaction based on assessment task *(OC1)*
Few peers interaction as not part of assessment task *(SC2)*	Peer interaction based on assessment task *(OC1)*	Peer interaction by due date of research proposal *(OC2)*
Few peers interaction before due date of students' research proposal *(SC3)*	Peer interaction by due date of research proposal *(OC2)*	

The open coding is followed with the development of themes that will be explored further.

3.7.2.1.3 Themes Development

Themes are identified by summarizing each piece of data within the explicit meanings of data. Also, themes refer to a level of a pattern response at the minimum describes the possible observations together with the maximum understandable aspects of phenomenon (Boyatzis 1998; Braun & Clarke 2006).

Example of how the open codes are categorised into themes is in table 3.10

Table 3.10: Example of how the open codes are categorised into themes

Open codes	Deleted duplicate open codes	Themes
Peer interaction based on assessment task *(OC1)*	Peer interaction based on assessment task *(OC1)*	**Assessment driven**
Peer interaction based on assessment task *(OC1)*	Peer interaction by due date of research proposal *(OC2)*	**Time management**
Peer interaction by due date of research proposal *(OC2)*		

Themes were developed by using inductive and deductive coding (see figure 3.10). The inductive approach was used on phase one data by observing data in specific situations to create rules or general conclusions by working toward abstract concepts. It was important for phase one to use a bottom approach to ensure that coding process commenced with a grounded approach. Phase two and three data that built on the outcome of phase one data while still adopting a grounded approach. In saying this new themes were discovered during phase two and three.

Using the deductive method is considered with those general rules as hypotheses for investigating new data in specific situations as checking the authenticity again (Fereday & Muir-Cochrane 2006; Neuman 2011; Thomas 2006). Deduction started from ideas toward visible evidence that increased the familiarity among individual and decrease the negative belief and confidence of participants. Deductive coding was undertaken in stage two by starting with developed themes from stage one as top to bottom direction. Finally, the list of themes were the result of qualitative data analysis. (Fereday & Muir-Cochrane 2006)

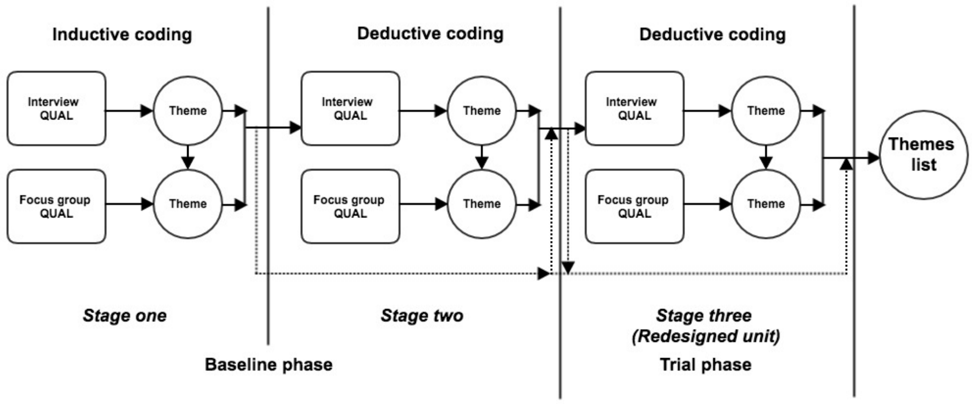


Figure 3.10 The procedure of themes development

Stage one produced 13 themes, stage 2 data supported the themes from stage one and produced 2 new themes. Stage 3 data supported stage one and two, while adding 7 new themes.

Section 3.7 presents the methods used in the analysis of the data collected for the research. The next section presented the research findings / results.

3.8 Results / Findings

The research findings were come from data interpretation by the integration of both quantitative and qualitative results. This integration is represented by using concurrent triangulation approach (Creswell, Plano Clark & Hanson 2003).

The interpretation of the research findings and discussion is presented in relation to the aim of the research and the research questions. Also the interpretation of the research findings continued to produce four key research findings.

The four key research findings are demonstrated in relation to the existing body of knowledge and the inter-relationships across data insight of technology-supported peer learning activities enhancing students learning experience. The research key findings are presented in chapter 7.

3.9 Researcher Bias

As identified in chapter 3, the researcher presumed a subjective ontological perspective while undertaking this research. A subjective ontological stance holds the view that the researcher is personally involved with the activities conducted as part of the research and cannot conduct observations of, or interactions with, the participants if detached from the phenomena under investigation. Subjectivity can guide the researcher in everything they do, from the choice of the topic being studied, through formulating hypothesis, through to the choice of methodologies, and finally – how we interpret data (Ratner 2002). Past experiences, current viewpoints and cultural convictions can all influence the perception of the phenomenon by the researcher (Neuman 2014; Ratner 2002).

Within this research, the data has been kept as clean and free of bias as possible. Definitions of measures used in the analytical stages have been conducted from as neutral a stance as possible, to minimize bias from the researcher's viewpoint or previous life experiences. Any interpreted qualification of data is therefore based on observed grouping within the data and should be recognisable as being both conceivable and verifiable by readers of the research.

Moreover, the researcher's own personal bias can affect the collection and analysis of data, but this can be overcome by attention to research design and careful research data analysis (Maxwell 2012). The research design, including data collection and analysis, this took place over two years and involved both students and teachers' points of view, using surveys and discussion boards for quantitative data collection and analysis, as well as interviews with teaching team and focus groups with students for qualitative data collection and analysis. This research design included the unit coordinators who have expertise in the area, and the units were delivered as described in the unit outline. This idea is also endorsed by Miles and Huberman (1994) who acknowledged that the researcher could avoid co-optation or going inherent by herself staying away from the site.

In addition, the researcher overcame any potentially introduced bias during coding of the data experienced as a component of her previous research training. This was evident when working with her supervisor during every stage of the analysis process and comparing samples, ensuring bias was not introduced into the process while confirming that her analysis was aligned at each stage. She also reduced bias by using an inductive approach in the first stage, followed by deductive in the second stage. The interesting thing with the second stage is that any data that did not fit into the defined themes, it was not disregarded but included by creating new theme.

3.10 Chapter Summary

This chapter has presented the description of research methodology that was used in the undertaking of this research. The subjective ontology and interpretivist epistemology were deemed to be the most appropriate for this research. The research strategy consisted of case study and three stages approach. Case study allows the researcher to understand that selected case over time period without bias and to investigate the fact of human involvement.

The research design consisted of four phases of research process supported by a mixed method with concurrent triangulation approach. The data collection tools and techniques were used across the three stages from four phases of the research process. Discussion boards and surveys were used for quantitative data collection. Focus group and semi-structure interview were used for qualitative data collection.

The data analysis approaches across the three stages and four phases of the research process: Social network analysis, descriptive analysis, factor analysis and thematic coding.

The results from quantitative and qualitative data analysis were integrated during the interpretation of the study The next chapter will present quantitative data analysis

Chapter 4: Quantitative Data Analysis and Results

4.1 Introduction

This chapter describes the quantitative analysis of collected data using the methodology presented within chapter three. There are two sets of collected quantitative data: the discussion board data from MyLO and the online surveys completed by student participants. As described in chapter three, data analysis was done in 3 stages (3 semesters) case study of three educational units. Analysis of the first two stages was conducted and informed unit design suggestions before a confirmatory analysis of last stage data on the redesigned unit.

This chapter is divided into the following sections:

- Section 4.2 describes the analysis from social network analysis approach as described in Chapter 3. The data graphically represents the changing of the social relationships of the student participants at two different time points: beginning of semester in week 3 and end of semester in week 11;

- Section 4.3 describes the analysis from descriptive spreadsheet analysis approach as described in Chapter 3. The data from the surveys was analysed in order to gain an understanding of the student participants' learning experience. This section graphically presents the results from the analysis along with descriptions of the outcomes;

- Section 4.4 describes the outcomes from the factor analysis approach as described in Chapter 3. The data from the surveys was analysed in order to describe variability among correlated variables in terms of factors. The emerging 'factors' are presented in this section;

- Section 4.5 compares the outcomes from each analysis approach in order to identify the similarities and differences that presented; and

- Section 4.6 summarises the outcomes and results for the chapter.

4.2 Social Network Analysis (SNA)

This section will present the social network analysis. The social network diagrams were created by using the data evidencing student participants' interaction with the discussion board from MyLO. These diagrams were used to identify any changes of social relationship or connection between each of the participants at two different time points in relation to semester (13 weeks): beginning of semester in week 3 and end of semester in week 11.

There were 3 different units for consideration as follows

- Unit one: Reflective unit with three assessment tasks for undergraduate students
- Unit two: Foundation unit with two working groups for undergraduate students
- Unit three: Negotiated unit for postgraduate students

Also, 3 stages were investigated with different purposes as follows

- Stage one with unit one for initial analysis
- Stage two with unit one and unit two for complementary analysis to get more data of students interaction
- Last stage with unit two and unit three for confirmation analysis of suggestion strategies for redesigning two units for engagement of peer interaction and technology

4.2.1 SNA stage one

Unit One

The initial data analysis examined the number of threads and replies from the discussion board. Unit one concentrated on undergraduate students utilizing 3 assessment tasks for submission on week 5 and week 13 (see table 4.1).

Table 4.1: Data of titles, threads, and replies from discussion board on MyLO

Forum title	Topic title	Threads	Replies
Weekly topic based discussions	Week #1 information session discussion practice	112	180
Weekly topic based discussions	Week #2 information session discussion for AT1	90	124
Weekly topic based discussions	Week #3 information session discussion for AT1	91	95
Weekly topic based discussions	Week #4 information session discussion for AT1	83	90
Weekly topic based discussions	Week #5 information session discussion for AT1	0	0
Weekly topic based discussions	Week #6 information session discussion for AT1	0	0
Weekly topic based discussions	Week #7 information session discussion for AT1	0	0
Weekly topic based discussions	Week #8 information session discussion for AT2	37	14
Weekly topic based discussions	Week #9 information session discussion for AT2	19	10
Weekly topic based discussions	Week #10 information session discussion for AT2	17	6
Weekly topic based discussions	Week #11 information session discussion for AT2	13	2
Weekly topic based discussions	Week #12 information session discussion for AT2	9	4
Tutorial Discussion Forum	Week #1 Tutorial Discussion	0	0
Tutorial Discussion Forum	Week #2 Tutorial Discussion	163	288
Tutorial Discussion Forum	Week #3 Tutorial Discussion	161	288
Tutorial Discussion Forum	Week #4 Tutorial Discussion	157	240
Tutorial Discussion Forum	Week #5 Tutorial Discussion	132	158
Tutorial Discussion Forum	Week #6 Tutorial Discussion	126	164
Tutorial Discussion Forum	Week #7 Tutorial Discussion	86	77
Tutorial Discussion Forum	Week #8 Tutorial Discussion	66	77
Tutorial Discussion Forum	Week #9 Tutorial Discussion	47	67
Tutorial Discussion Forum	Week #10 Tutorial Discussion	27	24
Tutorial Discussion Forum	Week #11 Tutorial Discussion	13	7
Tutorial Discussion Forum	Week #12 Tutorial Discussion	3	0

Also, as shown in figure 4.1, students interact with each other according to the assessment tasks and they did not interact during semester break in week 5-7. Figure 4.1 demonstrates the high level of interaction between students in the early stages of the semester. This is primarily due to the current unit design where assignments 1 and 2 are integral with developing initial postings, collecting responses and reflecting on original posts influenced by comments received from other students. After the mid semester break this requirement to engage with the discussion forums is not mandated and engagement levels dropped accordingly.

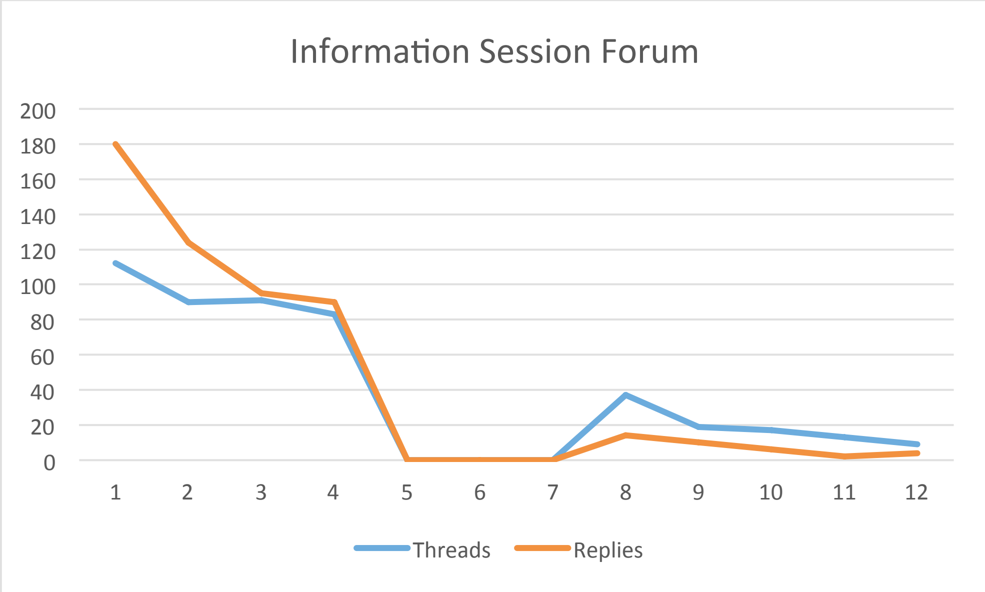


Figure 4.1: SNA stage one, student information session discussion interaction

As illustrated in figure 4.2, students' interaction increased rapidly at the beginning of semester and then petered off after semester break in week 7. This emphasises the teaching team's unit design by requiring students to interact early in the unit and then not require mandatory interaction after semester break based on assessment tasks.

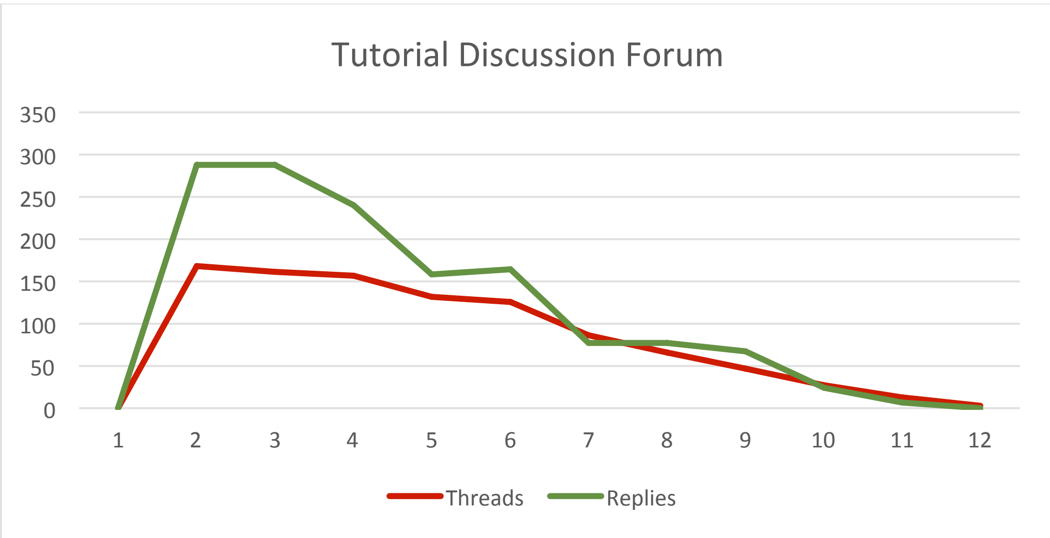


Figure 4.2: SNA stage one, student tutorial discussion interaction

Then, making more meaningful data from the discussion board on MyLO was considered with unit one and unit two in stage two.

4.2.2 SNA stage two

In stage two, students' interaction in unit one and unit two are shown according to the time frame. Different units have different assignments (assessment tasks) and different activities. Unit one and unit two have different instructor and teaching team. Especially, weekly topics based discussions and tutorial discussions are different. On the one hand weekly topics based discussions are prepared for students' group assignment as required, but on the other hand tutorial discussions are prepared for students' understanding how to learn and work for any assignment.

The differences of conditions between two units will be described as follows:

Unit One

The relationship of student participants' interaction from unit one is shown in figure 4.3. The social diagram shows the social interaction between students using the discussion board. There are three numbers used within this diagram (x, y, z) representing (x) number of threads, (y) number of replies and (z) number of read, for example, (1,1,4), 1 thread, 1 reply, 4 reads.

From beginning of semester in week 3, some students demonstrated good communication with other students. Some of them have two-ways interaction and some of them have one-way interaction. Moreover, it is clear that students do not need support or guidance from the teaching team in the discussion forums. Toward the end of semester in week 11, some student did not get responses from others, so they tried to repost again and then other students replied to their post.

Week3

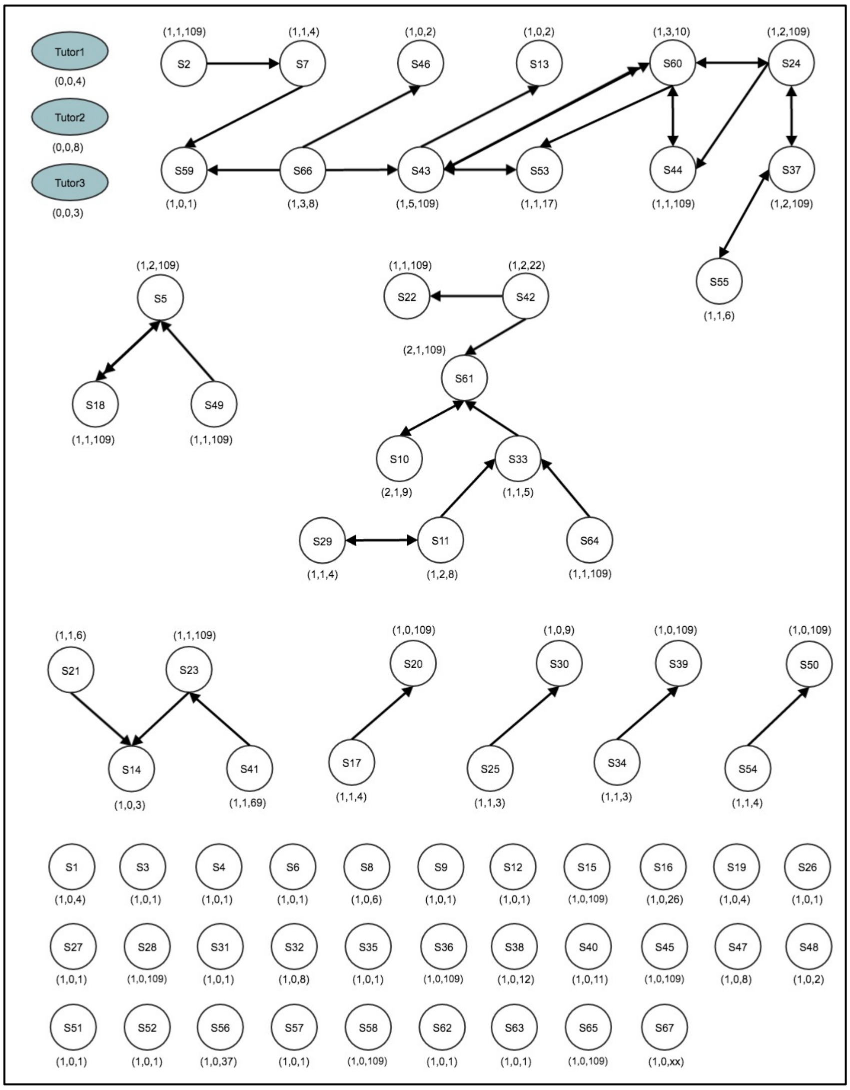
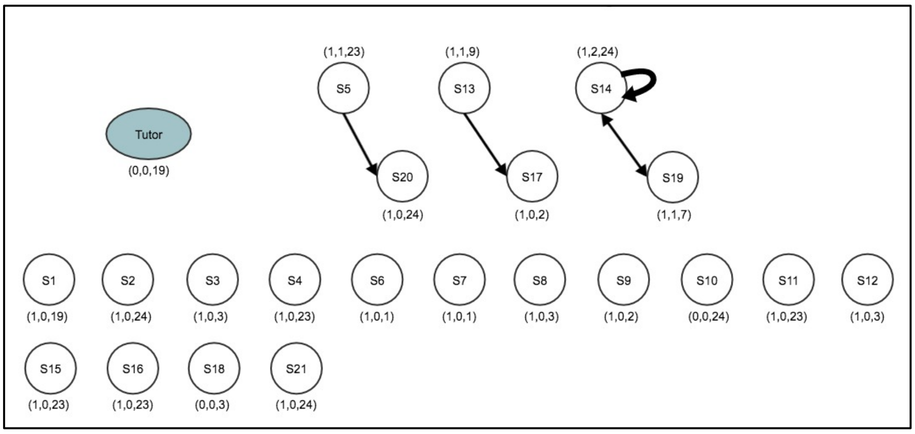


Figure 4.3: SNA, stage two, unit one, week three

The diagram of students' interaction between week 3 and week 11 is different based on the assessment task. From figure 4.3, a snapshot in week 3 shows that students' engagement in discussion is mandatory in regards to assignment 1 as presented earlier in SNA stage one. Moreover, teaching team only observed how students interacted with each other and some students interacted easier because they encouraged other students for their participation. Also, some students might not be engaging because they did not interact with other students.

Week11



Note: (x, y, z) means (number of threads, number of replies, and number of read (including own).
XX or X means N/A
Sx means active students
S0 means inactive students
Arrow is shown the direction of reply, Number of arrow is shown number of reply

Figure 4.4: SNA, stage two, unit one, week eleven

From figure 4.4, snapshot in week 11 it is shown that students' engagement was not required as part of assessment task of assignment 2.

Unit Two

The relationship of student participants' interaction from unit two is shown in figure 4.4. From the assessment task design of this unit there are two separated working groups in week 3. In group 1, students have one-way interaction and they are not seen to engage with the teacher. In group 2, some students need support from teacher. Someone have one-way interaction and someone have two-ways interaction.

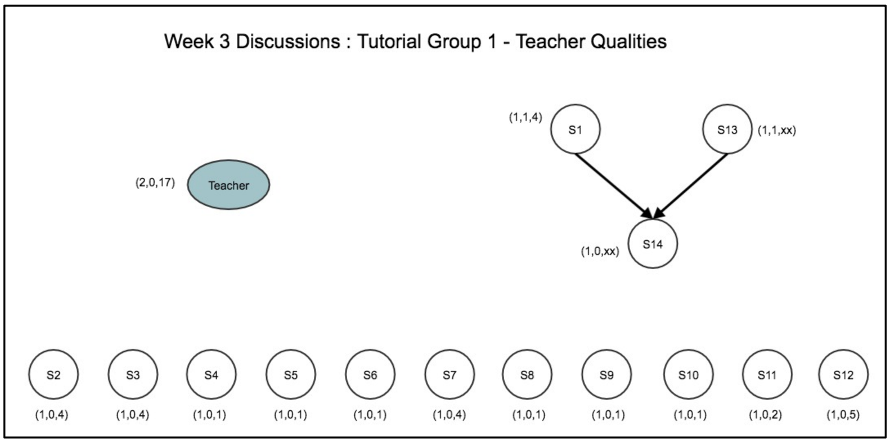


Figure 4.5: SNA, stage two, unit two, week three (group one)

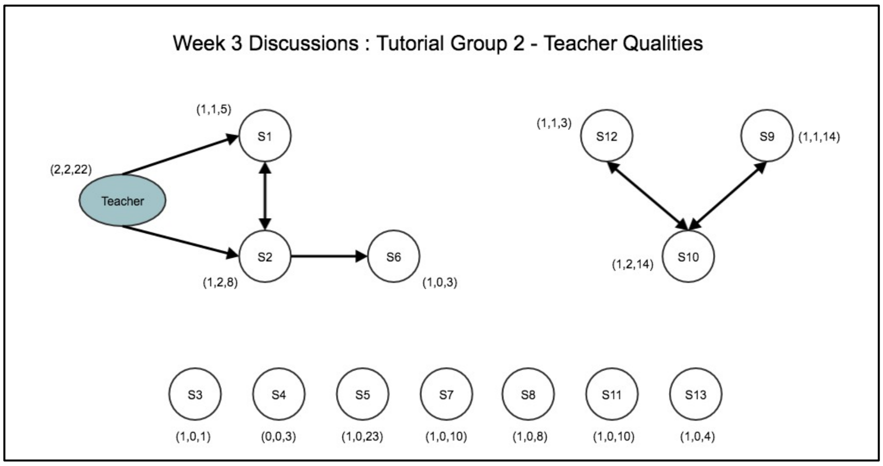


Figure 4.6: SNA, stage two, unit two, week three (group two)

From stage two unit two, students' interaction in week 3 group 1 is less than students' interaction in week 3 group 2 because of more encouragement by teaching team of group 2. (See figure 4.5 and figure 4.6)

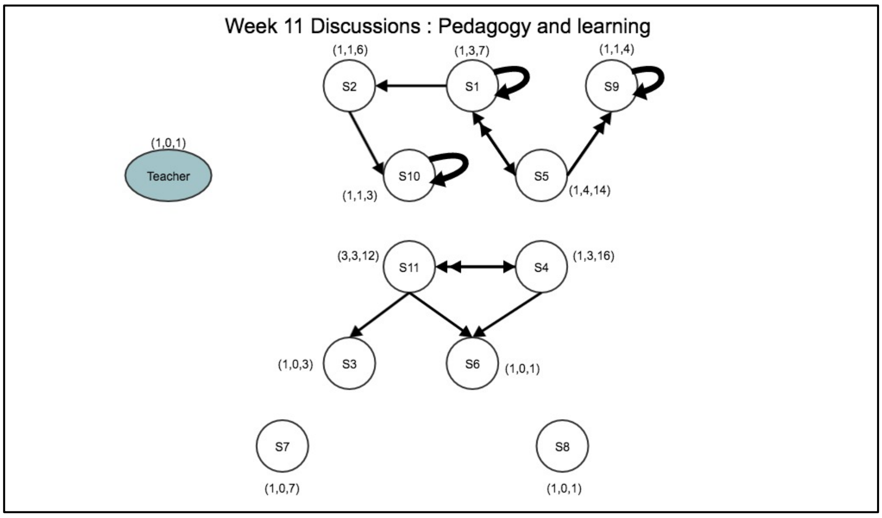


Figure 4.7: SNA, stage two, unit two, week eleven

In week 11 (see figure 4.7), there is not any separated working group according to course outline. Students demonstrated good levels of communication in this week. Some students did not get response from other students [this may have been a result of a particular student having different topic of interest to other students] so he or she reposts again and then someone else who have same topics of interest reply back to him or her. Also, students who did interaction before in week 3, they encouraged or engaged other students to interact with each other in week 11.

According to the results of the social network analysis in stage two, some students have two-way interaction, some have one-way interaction, and some may not get any response from other students. Interestingly, after some students posted their messages and did not get response, they reposted the message again then they got a response from other students who had same topics of interest but may have not read their earlier post. Moreover, when students interacted with each other in the same interests, social learning and sharing of experiences can be occurred through their own contemplation of the ideas. Sometimes, the connection of relationships within the group may be forwarded through one person to another. This created a network or community of learning. However, some were still interested in only reading the comments of others and not responding. It is significant that a network or community of learning is able to encourage students to express their own opinions for further sharing to other students and continue to do peer learning activities together.

4.2.3 SNA stage three

After providing evidence and suggestions to teaching teams of units two and three, SNA stage three was a confirmatory analysis done on the levels of engagement of students using the discussion forums. Student orientation sessions within each unit were initiated ensuring students understanding of their role and the teaching team's role was presented clearly. This included the objectives of learning activities and how these activities were technology-supported.

Unit two

The relationship of student participants' interaction from unit two is shown in figures 4.8 – 4.11. After teacher and teaching team have already informed all students during orientation about the details of the tasks and assignments according to the unit outline including their responsibilities.

In this unit, students were divided into two groups to do learning activities. When students understood their role in participating in discussions with other students, they were actively posting and waiting for any responses.

In week 3 (see figure 4.8 and figure 4.10), students had more interaction with each other during the comprehensive learning activities with feedback received from other students through the discussion board. The interaction consisted of both one-way and two-ways communication together with more than one interaction time. Although the central design was still around the teacher or teaching team being the communication focus, it was an interesting observation from the data that some students stepped up and also served as a centre of communication among other students. These students were able to support other students reducing the need for relying on only a teacher's support. Also, some students tried and succeeded in posting several messages to students that shared the same interests by responding to comments of several other students as well as encouraging those students that had not posted into a discussion. Moreover, each student had different personal experiences, and these various ideas' appear to have been shared depending on personal interests and convenience of other students.

In week 11 (see figure 4.9 and figure 4.11), it was possible that those students demonstrating lower levels of interaction in the discussion board were influenced by the impending examinations in week 15-18. However, some students who received responses from their peers in week 3, felt accountable to interact with those peers in week 11 as well. Moreover, a network or community of learning was created among students and students were again encouraged to interact with each other by the support of the teaching team.

It can be observed that most students who interacted with one another at the beginning of semester, continued to interact and encourage others who may not have interacted with each other at the end of the semester. They also interacted together for same topics of interest according to their assessment tasks.

Also, the teacher and teaching team posted their response to encourage each student to have more confidence in their interaction with other students. However, it is important that students will continue to learn and exchange ideas and learning experience with each other as long as they pay attention to their meaningful interests (posted topics).

Interestingly, there was a lot of students' interaction in unit two because teaching team was actively engaging and encouraging students to interact with each other. In unit two, teaching team were engaged to do more personal level discussion because in the previous diagram of stage one and stage two, the teaching team was only observing the conversations between students and they were not actively responding.

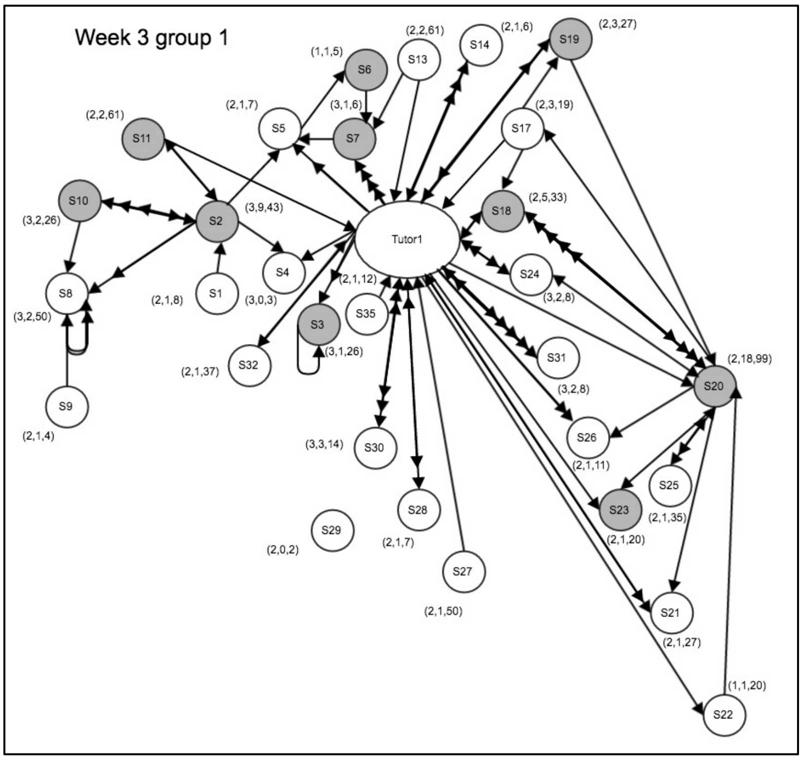


Figure 4.8: SNA stage three, unit two, week three (group one)

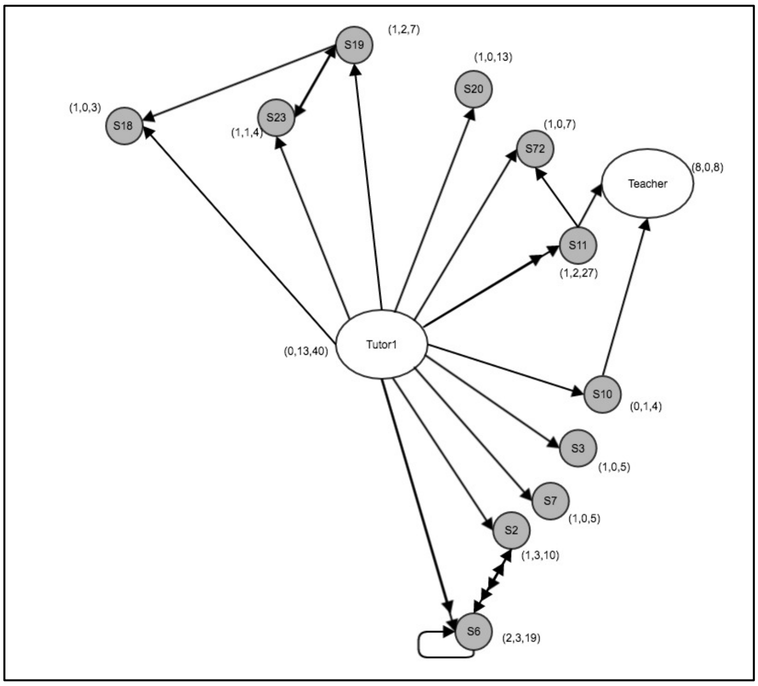


Figure 4.9: SNA stage three, unit two, week eleven (group one)

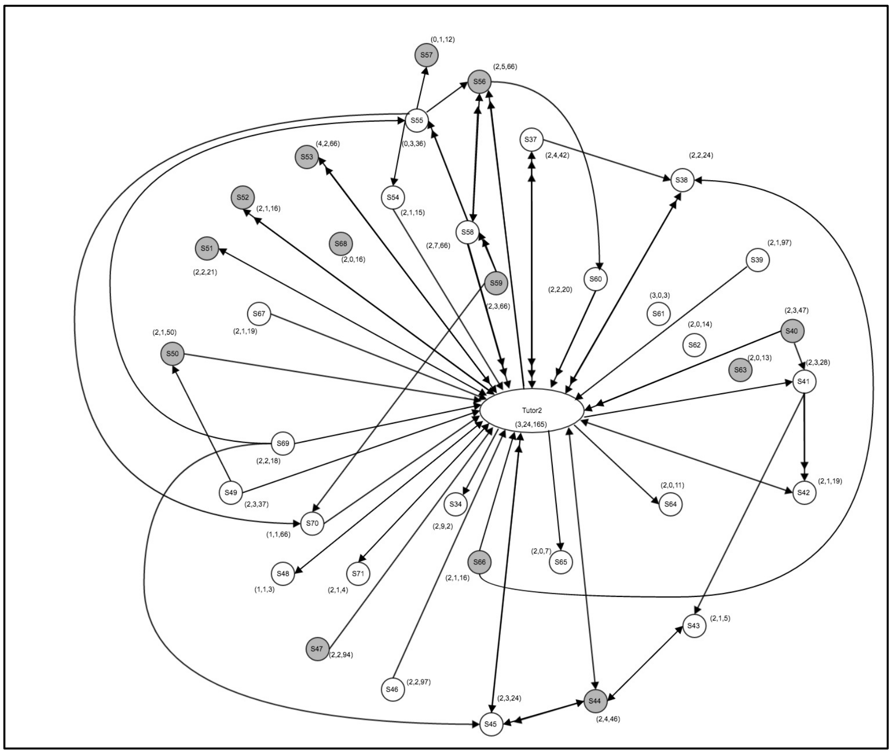


Figure 4.10: SNA stage three, unit two, week three (group two)

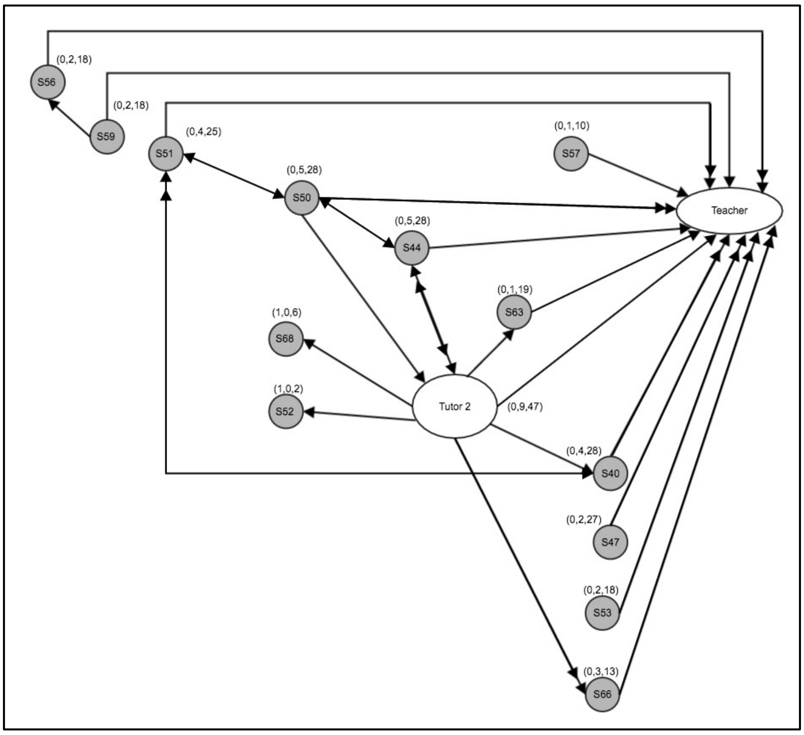


Figure 4.11: SNA stage three, unit two, week eleven (group two)

Unit Three

The relationship of student participants' interaction from unit three is shown in figure 4.12 and figure 4.13. Similarly to unit two, after the teaching team have already informed all students during orientation about the details of the assessment tasks and assignments according to the unit outline including their responsibilities.

In week 3 (see figure 4.12), students had more interaction with each other by the comprehensive learning activities with feedbacks through discussion board. The interaction consisted of both one-way and two-ways communication together with more than one interaction time. Interestingly, some students stood at a centre among peers as centred students support other students without relying on teacher's support. Each student had different learning experience, and various ideas' sharing depending on their own interests. Some students had no interaction. They sometimes posted more than once, it is also possible that they are highly interested in that topic and they encouraged other students gave them the comments or ideas accordingly. Also, their posts relied on the assessment task and assignment of the unit with the expectation of students' interaction with one another.

In week 11 (see figure 4.13), it was possible that lower student's interaction on the discussion board were influenced by the examination. Significantly, the discussion of week 11 was not compulsory in the assignment of this unit. Some students were at the centre to support other students. There were only some students who had continued interaction at the end of semester because of the importance of interaction and sharing learning experiences.

Again, redesigned unit three in week 3 shows that students' interacted more based on the teaching team's active engagement (see figure 4.12). Students have less interaction in week 11 because of no teaching team engagement (see figure 4.13).

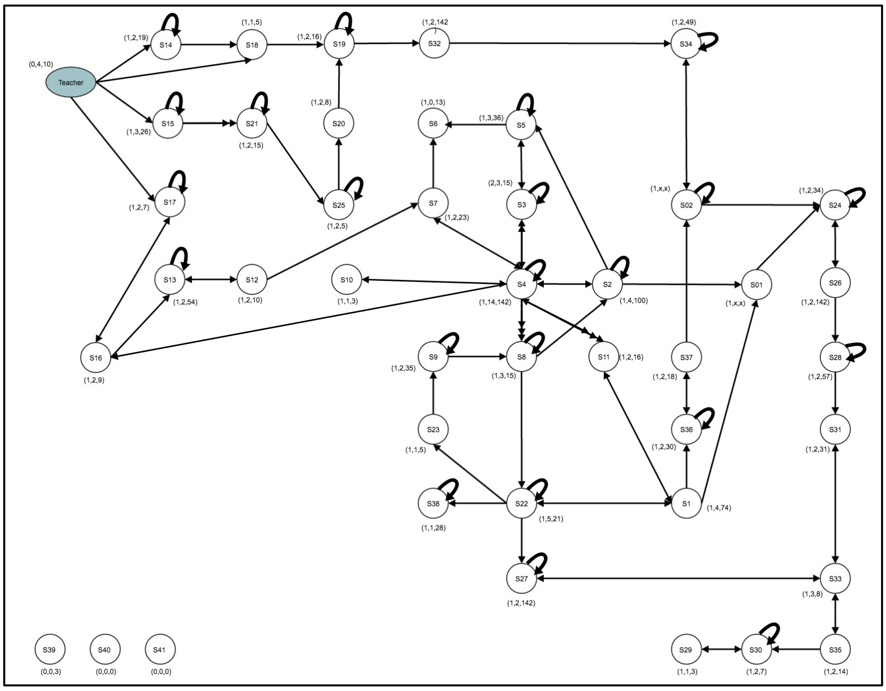


Figure 4.12: SNA stage three, unit three, week three

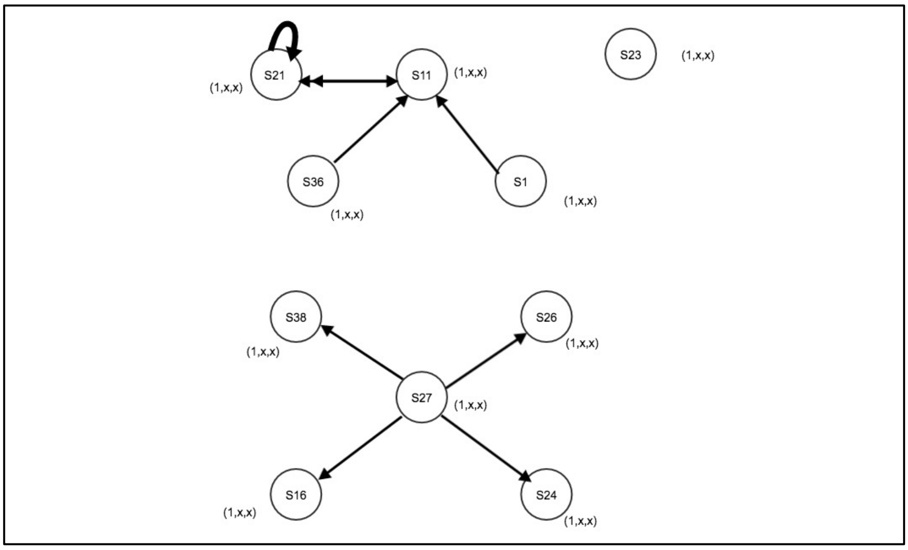


Figure 4.13: SNA stage three, unit three, week eleven

According to the social network analysis in stage three, teaching team should remind students of their responsibility to review and see the importance of the exchange of their own ideas and experiences with each other. It is a good start of peer learning for sharing learning experience in online environment.

According to the unit outline together with the associated assessment tasks and required mandatory group participation for discussions, students were required to interact and exchange ideas and experiences with each other. Also, students continue to interact with each other constantly since the beginning of the semester until the end of semester after they attended the supportive orientation together with encouragement by teaching team.

From unit two, students were divided into two groups for learning activities. It was shown that the way instructors divided by group also impacted peer-interaction and increased students' received replies. Moreover, It seems a very interesting analysis through social network analysis to investigate peer-learning and interaction; however, there are many variables and factors which might influences peer-learning and peer-interactions, such as contents, grade levels, number of students in the class, requirements of learning management system's policy, course organizations (examination date and time), delivery approaches (e.g., divided into small groups, whole class discussion board), grading systems. The three units evaluated students' interaction with the required post threads and replies in each unit according to group assignment tasks. Although the number of threads and number of replies are not specified, these numbers can be changed dramatically based on students' interaction with each other.

It is interesting how students were continuing to exchange ideas and experiences all semester and how to encourage some students to serve as hubs or centres of learning without interaction with teacher.

4.3 Descriptive Spreadsheet Analysis (DSA)

This section will graphically present the descriptive spreadsheet analysis completed primarily using Microsoft Excel spreadsheets. The data used for this analysis was gathered from student responses to two online surveys. These surveys were made available to students in weeks three and eleven of semester. The results were used to clarify what students understood as their learning experience and included Likert scale preference values as well as open ended feedback and comments.

These surveys were based on the Constructivist On-Line Learning Environment Survey (COLLES) and further adapted to better investigate the research questions channelling this research. The six original sections of the survey were used and included relevance, reflection, interaction, teacher support, peer support and making sense. And additional section was created to extend the survey which was titled course technology.

Students volunteer to participate and spend time responding with feedback are usually those who have a determined position about their learning experiences (Kop 2010). Students were asked to rate their response to the 32 statements (in the 7 parts of the survey, see Table 4.2) on a scale ranging from 5 (almost always) to 1 (almost never). Because the research focuses on the experiences that students receive from their own learning, therefore the only focus is on the 'almost always' that students have on their most influential topics.

Table 4.2: Adapted Constructivist On-Line Learning Environment Survey (COLLES)

Stmt no.	Relevance
1	My learning focuses on issues that interest me
2	What I learn is important for my professional practice
3	I learn how to improve my professional practice
4	What I learn connects well with my professional practice
	Reflection
5	I think critically about how I learn
6	I think critically about my own ideas
7	I think critically about other students' ideas
8	I think critically about ideas in the readings
9	I think critically about how I actively share my own ideas/experiences
10	I think critically about how I actively engage with other students ideas/experiences
11	I think critically about how being active and engaging with other students has improved my learning experience
	Interaction
12	I explain my ideas to other students
13	I ask other students to explain their ideas
14	Other students ask me to explain my ideas
15	Other students respond to my ideas
16	I feel accountable in how I interact with other students
	Teacher support
17	The teacher stimulates my thinking
18	The teacher encourages me to participate
19	The teacher models good discourse
20	The teacher models critical self-reflection
	Peer support
21	Other students encourage my participation
22	Other students praise my contribution
23	Other students value my contribution
24	Other students empathise with my struggle to learn

	Making Sense
25	I make good sense of other students' messages
26	Other students make good sense of my messages
27	I make good sense of the teacher's messages
28	The teacher makes good sense of my messages
	Course Technology
29	The course technology encourages my participation
30	The course technology supports my learning
31	The course technology improves my learning experience
32	The course technology enhances the learning activities

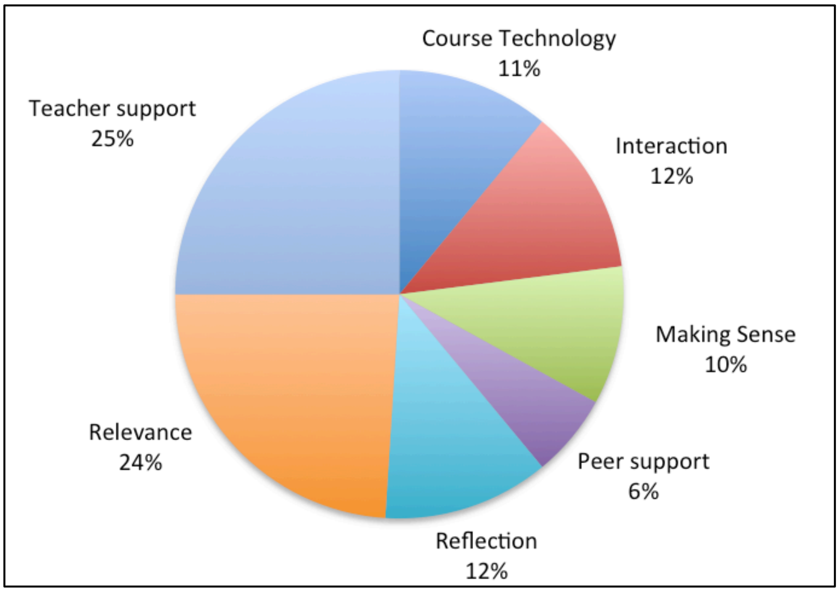
4.3.1 DSA stage one

Unit one

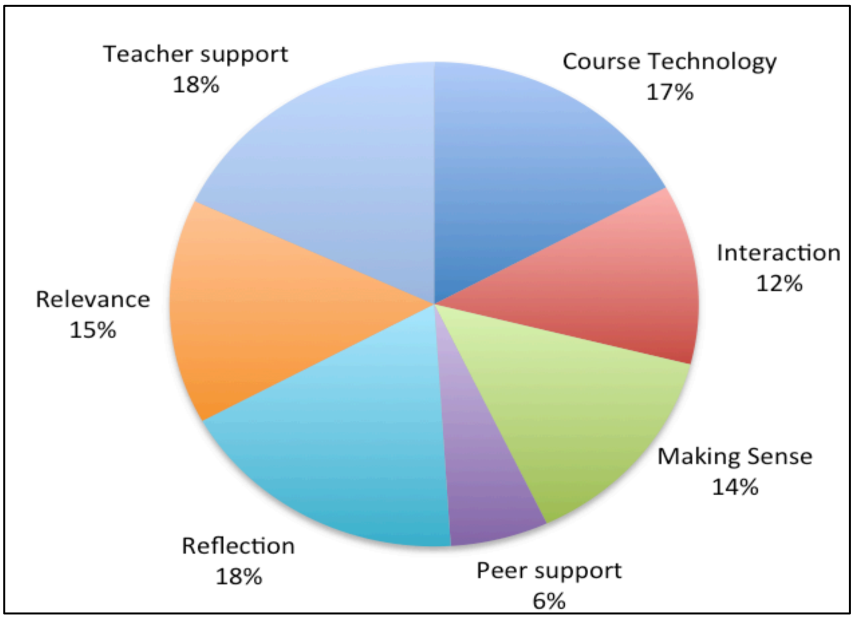
For unit one the response rate received was 14% of student population (n=26) for the online survey one and 12% of student population (n=24) for the online survey two.

Students were similarly asked to rate their response to 32 statements of 7 parts. From the online survey one, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.14 (a)): Interestingly, approximately 25% of respondents have their learning experiences influenced by either teacher support (25%) or relevance (24%). Either interaction or reflection influenced on students' learning experience in 12%. The influence of course technology and making sense of students' learning experience are 11% and 10% respectively. The remaining 6% is peer support that influences learning experience.

From the online survey two, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.14 (b)): It can be found that course technology, teacher support and reflection influence students' learning experience quite similar. The influence of relevance and making sense of students' learning experience are closely. The 12% of interaction and the 6% of peer support influence students' learning experience.



(a) Survey one responses



(b) Survey two responses

Figure 4.14: The comparison between survey one and survey two responses (DSA stage one, unit one)

Moreover, the online survey one shows that the students believed that teacher support and the relevance of the course material to their professional practice was of a high importance to them (almost half the chart). This would suggest that many initially believed that success could be more dependent on the teacher's ability and the quality of the content created to support their learning. In the other hand, the responses to the online survey two indicated that students became more self-directed in their learning and the relevance of participation in developing their own learning is considered. This can be seen through the gains in reflection from 12% to 18%, being able to use appropriate technology to communicate and therefore learn from 11% to 17%, and again making sense that is also about communication from 10% to 14%.

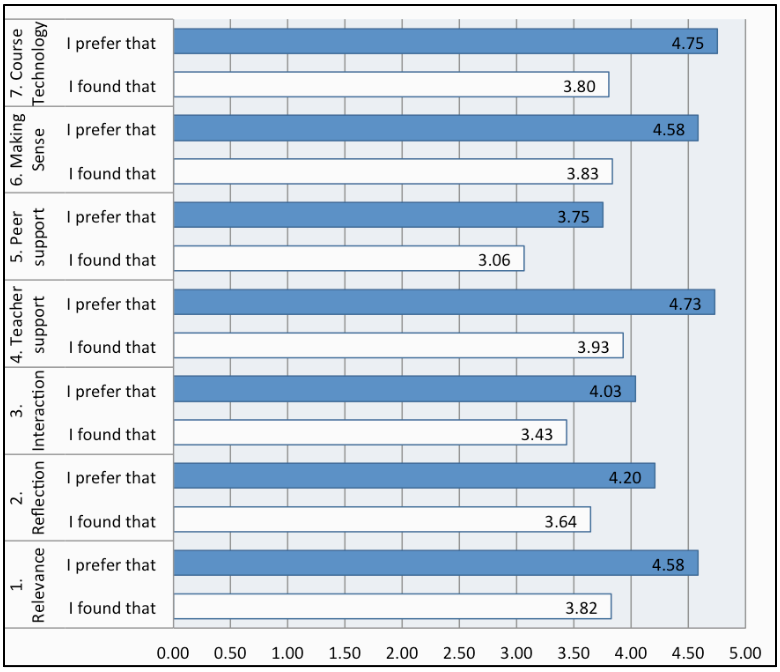


Figure 4.15: **The comparison between 'preference' (I prefer that) and 'feedback' (I found that) of 7 parts from survey two (DSA stage one, unit one)**

The difference of 7 factors from the online survey two is compared in Figure 4.15. It can be seen that the learners preferences all rated higher than what they believed they had experienced during the course. The highest average score of preference are course technology and teacher support with corresponding scales. Also feedback of teacher support is the highest average score. Average score of feedback in relevance, making sense and course technology is quite similar. The lowest average score of preference and feedback is peer support.

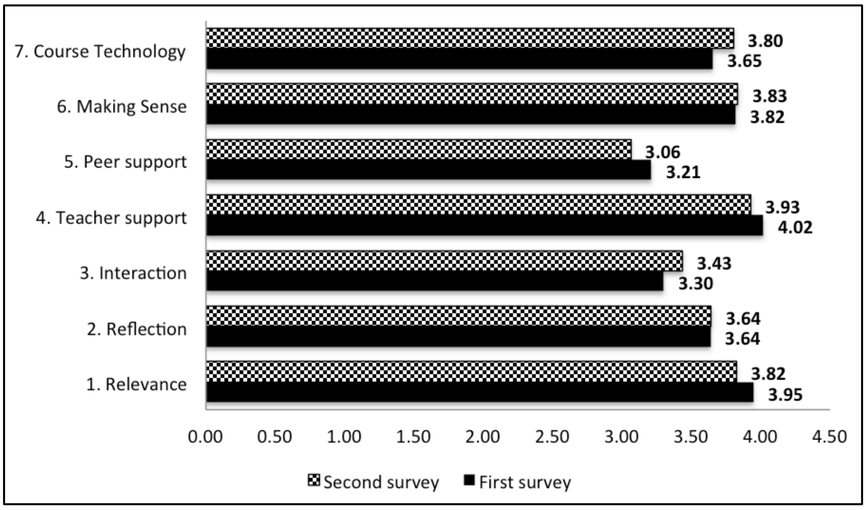


Figure 4.16: **The comparison between feedback of 7 parts from survey one and survey two (DSA stage one, unit one)**

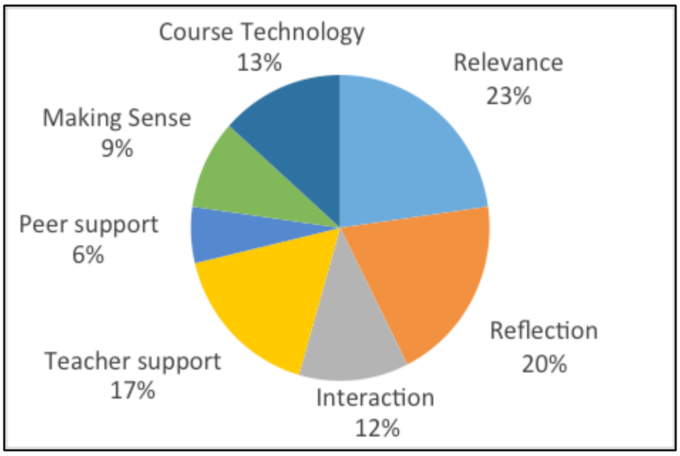
The comparison between the feedback ("I found that") from the online survey one and the online survey two is shown in Figure 4.16, which shows that at the end of semester, students found that their own reflection is still constant while the interaction is likely to increase by the support of the technology. Meanwhile, the teacher support decreases along with the declining peer support and the slight increase of making sense.

According to the results of the descriptive spreadsheet analysis in stage one, the outcomes show the demands of online studying and the trend of students who would like to improve their learning experience. They needed to apply technology to improve their learning among students. For a clearer understanding of the development of the exchange of students' ideas and experiences, by using technology together with the support of the teaching team, the analysis of data in two units was investigated in stage two.

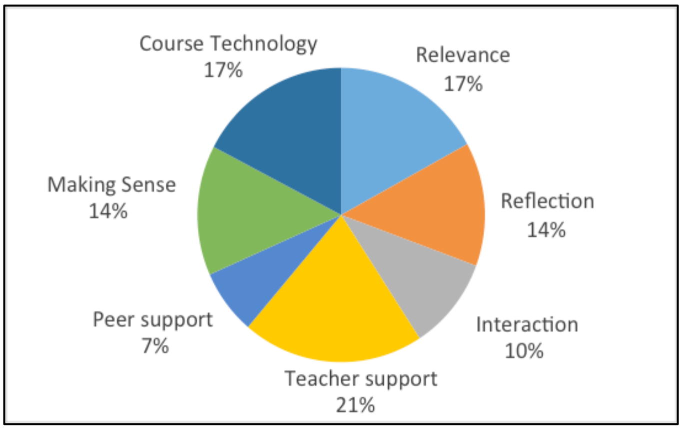
4.3.2 DSA stage two

Unit one

The response rate received was 14% of student population (n=38) for the online survey one and 12% of student population (n=12) for the online survey two.



(a) Survey one responses



(b) Survey two responses

Figure 4.17: **The comparison between survey one and survey two responses (DSA stage two, unit one)**

Students were similarly asked to rate their response to 32 statements of 7 parts. From online survey one according to the scale of influence 'almost always' according to students' learning experience (see Figure 4.17 (a)): Interestingly, approximately 20% of respondents have their learning experiences strongly influenced by either relevance (23%) or reflection (20%). 17% indicated it is teacher support that moderately influenced their learning experience. Low influence responses included course technology (13%) and interaction (12%), with making sense and peer support on students' learning experience indicating 9% and 6% respectively.

From online survey two, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.17 (b)): It can be found that teacher support (21%) significantly influenced the learning experience. Also, course technology (17%) and relevance (17%) moderately influenced students' learning experience. Making sense of the communication and reflection influenced students' learning experience by 14%. The factors of least influence on students' learning experience were interaction (10%) and peer support (7%).

Moreover, online survey one shows that the students believed that the relevance of their professional practices and the reflection for critical thinking were of a high importance to them. This would suggest that online students could be more dependent on students' accountability and interest. On the other hand, the responses to online survey two indicated that although students were still supported by teaching team, they were interested in using technology to improve their professional practices. In addition, making sense of communication was related to critical reflective thinking.

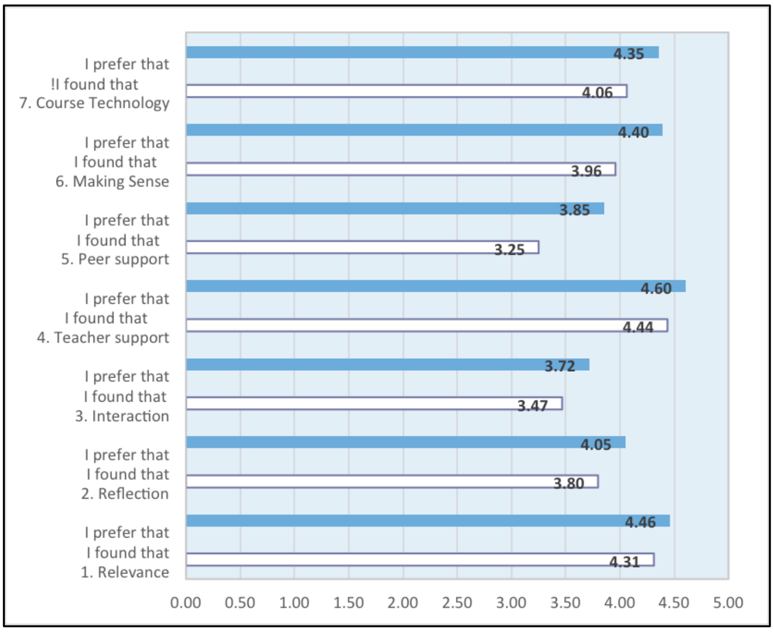


Figure 4.18: **The comparison between 'preference' (I prefer that) and 'feedback' (I found that) of 7 parts from survey two (DSA stage two, unit one)**

The difference of 7 factors from the online survey two is compared in Figure 4.18. After learners finished their studying at the end of semester, the learners' preferences all rated higher than what they believed they had experienced during the course. The highest average score of preference is teacher support (4.60) together with the next two highest average scores of relevance (4.46) and making sense (4.40). Also feedback of teacher support (4.44) is the highest average score with the nearest average score of relevance (4.31). Average score of feedback in making sense (3.96) and course technology (4.06) is quite similar. The two lowest average score of preference are interaction (3.72) and peer support (3.85). Also, the lowest average score of feedback are interaction (3.47) and peer support (3.25).

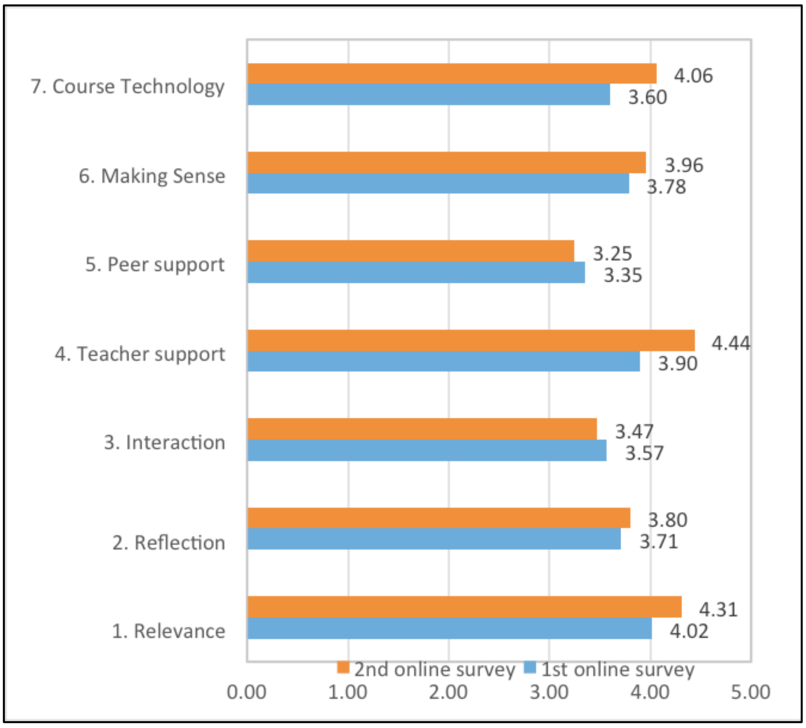
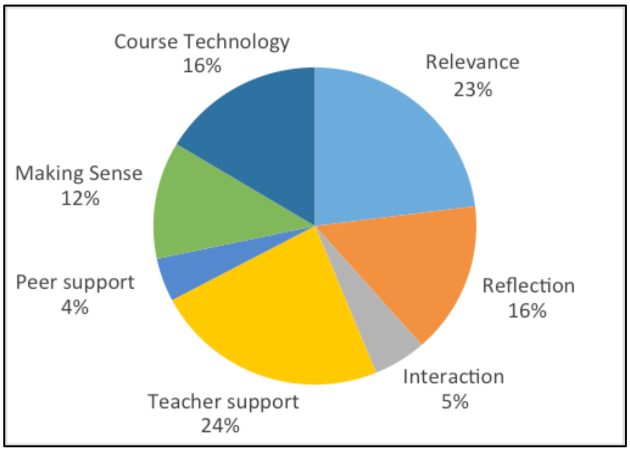


Figure 4.19: **The comparison between feedback of 7 parts from survey one and survey two (DSA stage two, unit one)**

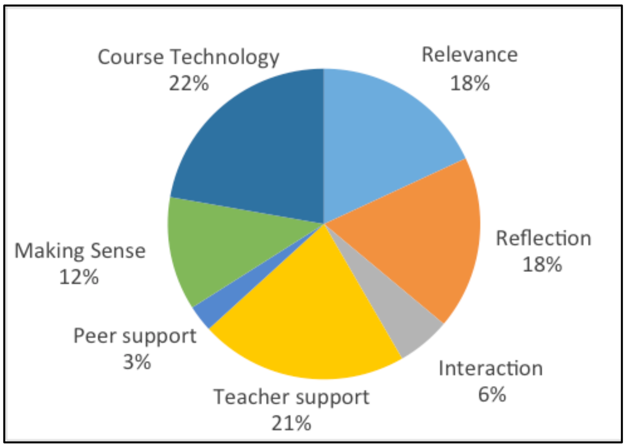
The comparison between the feedback from online survey one and online survey two is shown in Figure 4.19, which shows that at the end of semester, students found that their professional practices are important needing support from both teaching team and course technology. The trends of both interaction and peer support depended on each other. Moreover, making sense of communication and reflection for critical thinking were slightly increased.

Unit two

The response rate received was 14% of student population (n=25) for the online survey one and 4% of student population (n=7) for the online survey two.



(a) Survey one responses



(b) Survey two responses

Figure 4.20: **The comparison between survey one and survey two responses (DSA stage two, unit two)**

Students were similarly asked to rate their responses to 32 statements of 7 parts. From online survey one, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.20 (a)): Interestingly, both course technology and reflection influenced students' learning experience by 16%, both teacher support and relevance influenced students' learning experience by approximately 24%, and both peer support and interaction influenced students' learning experience by approximately 5%. Also, the influence of making sense on students' learning experience is 12%.

From the online survey two, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.20 (b)): It can be found that approximately 22% relate to teacher support and course technology that most influenced the learning experience. Both relevance and reflection influenced students' learning experience by 18%. The influences of interaction and peer support on students' learning experience are 6% and 3% respectively. Also, the influence of making sense on students' learning experience maintained at 12%.

Moreover, online survey one shows that the students believed that the teaching team was of a high importance to them, together with considering using technology to support their critical thinking. On the other hand, the responses to online survey two indicated that teaching team used technology to support students for professional practices and critical thinking. Peer support reduced in influence by the way students' interacted with each other.

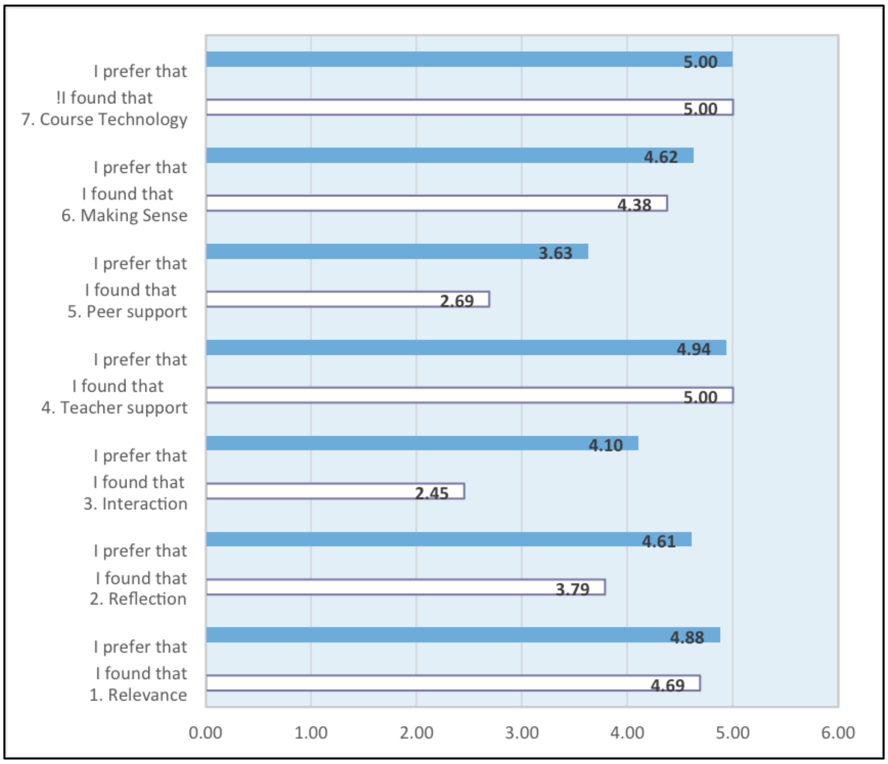


Figure 4.21: **The comparison between 'preference' (I prefer that) and 'feedback' (I found that) of 7 parts from survey two (DSA stage two, unit two)**

The difference of 7 factors from the online survey two is compared in Figure 4.21. It can be seen that the learners preferences all rated higher than what they believed they had experienced during the course except teacher support and course technology. The highest average score of preference is course technology (5.00) together with the nearest two high average score of teacher support (4.94) and relevance (4.88) with corresponding scales. Also, feedback of course technology and teacher support is the highest average score (5.00). The three lowest average scores of preference are interaction (2.45), peer support (2.69) and reflection (3.79).

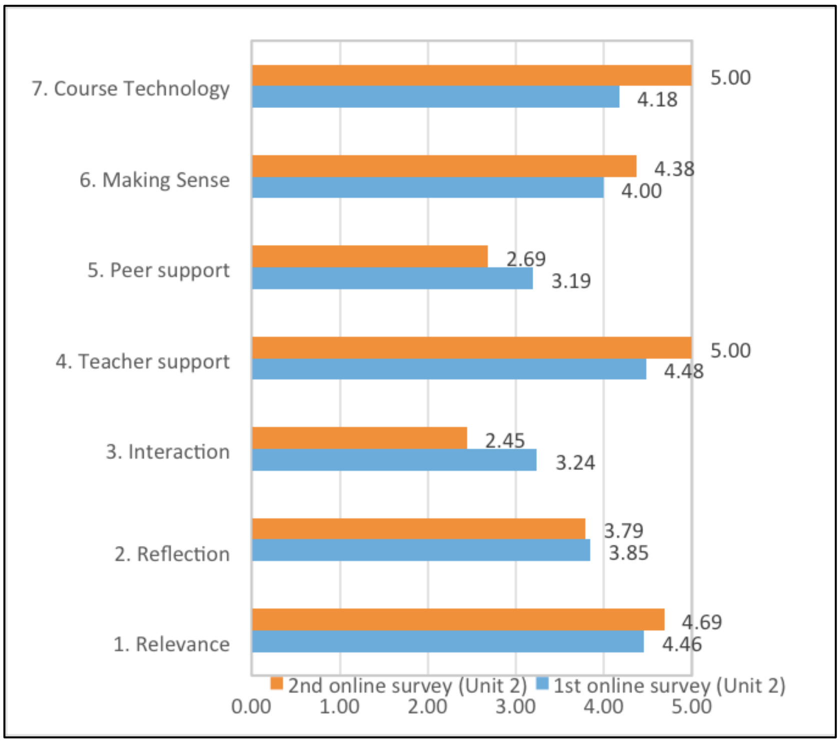


Figure 4.22: **The comparison between feedback of 7 parts from survey one and survey two (DSA stage two, unit two)**

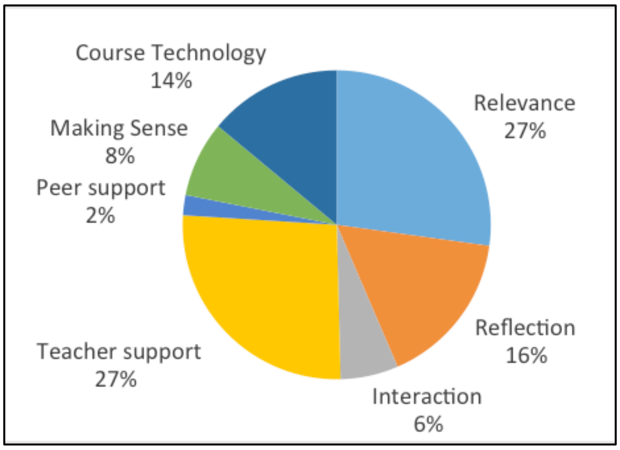
The comparison between the feedback from the online survey one and the online survey two is shown in Figure 4.22, which shows that at the end of semester, students found that both course technology and teacher support are important for their professional practices and making sense of communication. The trends of both interaction and peer support depended on each other. Moreover, reflection for critical thinking was slightly decreased.

According to the results of the descriptive spreadsheet analysis in stage two, students were able to learn better, with more sharing of their ideas or experiences and relied on technology as an important tool to support learning together online. Also, the teacher is another important element that supported students to interact with each other for further developing their professional practices and good communication.

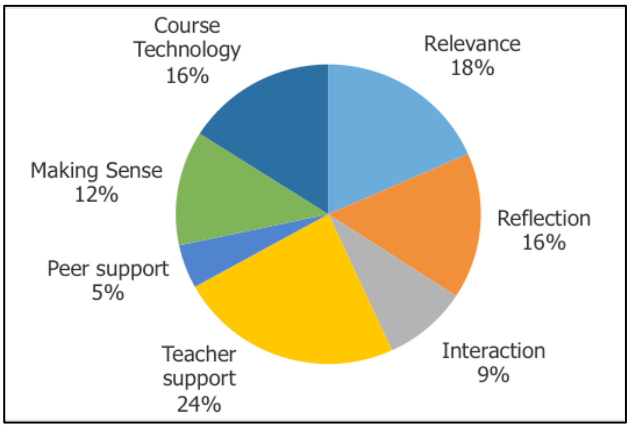
4.3.3 DSA stage three

Unit two

The response rate received was 19% of student population (n=62) for the online survey one and 8% of student population (n=28) for the online survey two.



(a) Survey one responses



(b) Survey two responses

Figure 4.23: **The comparison between survey one and survey two responses (DSA stage three, unit two)**

Students were similarly asked to rate their response to 32 statements of 7 parts. From the online survey one, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.23 (a)): Interestingly, 27% of respondents have their learning experiences influenced by relevance of professional practices and teacher support. The influences of reflection and course technology on students' learning experience are 16% and 14%

respectively. The least influential were making sense (8%), interaction (6 %) and peer support (2%).

From online survey two, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.23 (b)) it can be found that teacher support (24%) significantly influenced the learning experience. The relevance influenced students' learning experience by 18%. Also, the 16 % of course technology and reflection influence students' learning experience similar. The factors of least influence on students' learning experience were interaction (9%) and peer support (5%).

At the end of semester, using course technology increased while teacher support decreased. When students had more interaction, they also had more peer support. Moreover, reflection for professional practices and making sense for communication can be supported for students working together as well.

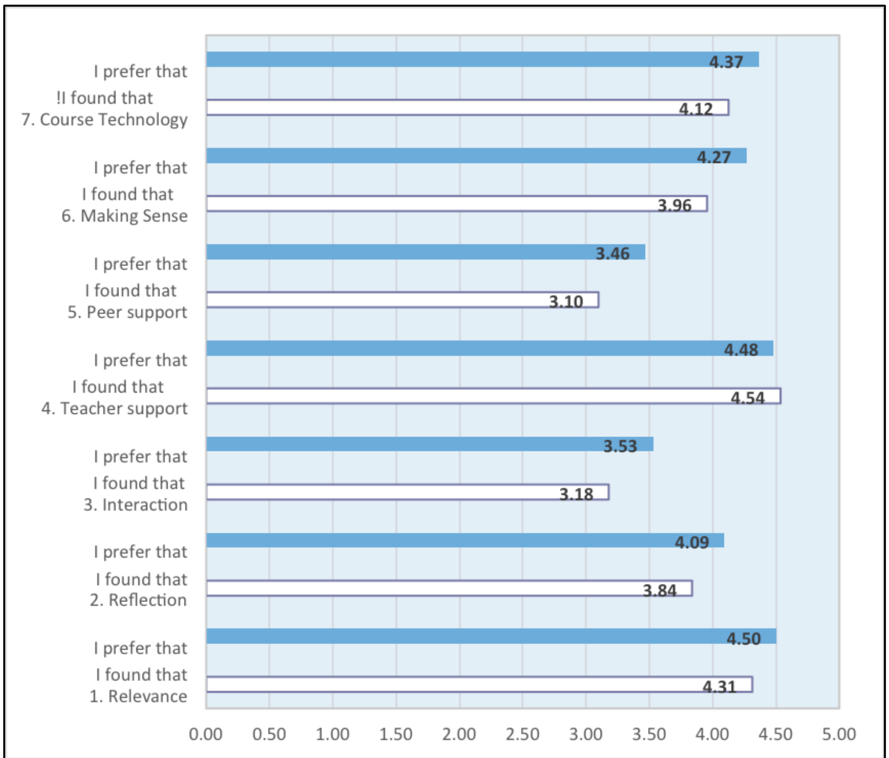


Figure 4.24: **The comparison between 'preference' (I prefer that) and 'feedback' (I found that) of 7 parts from survey two (DSA stage three, unit two)**

The difference of 7 factors from the online survey two is compared in Figure 4.24. It can be seen that the learners preferences all rated higher than what they believed they had experienced during the course except teacher support. The highest average score of preference is relevance (4.50) together with the next three highest average scores of teacher support (4.48), course technology (4.37) and making sense (4.27). Also, feedback of teacher support (4.54) is the highest average score. The last two lowest average score of feedback are interaction (3.18) and peer support (3.10).

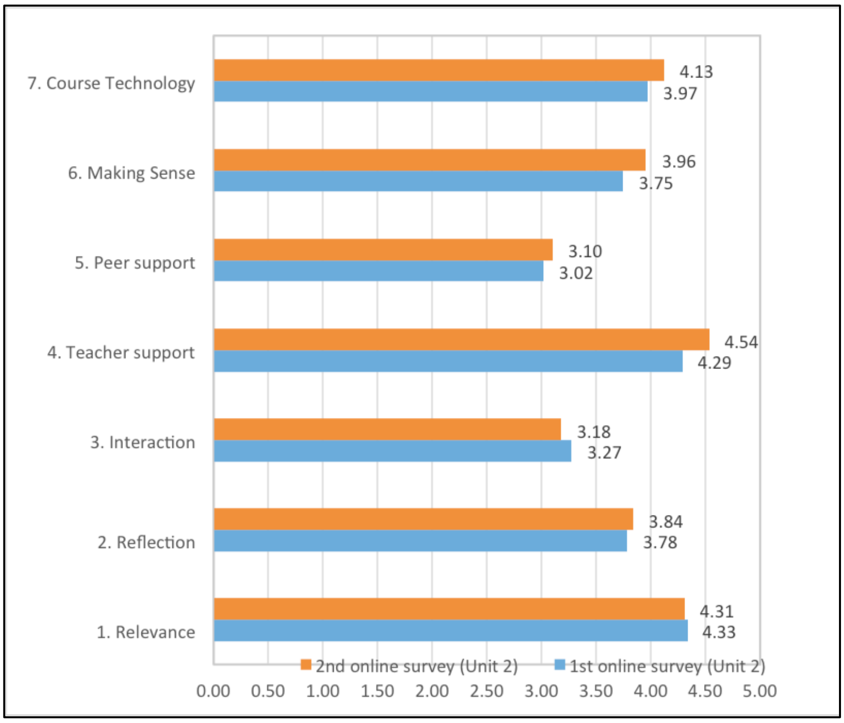
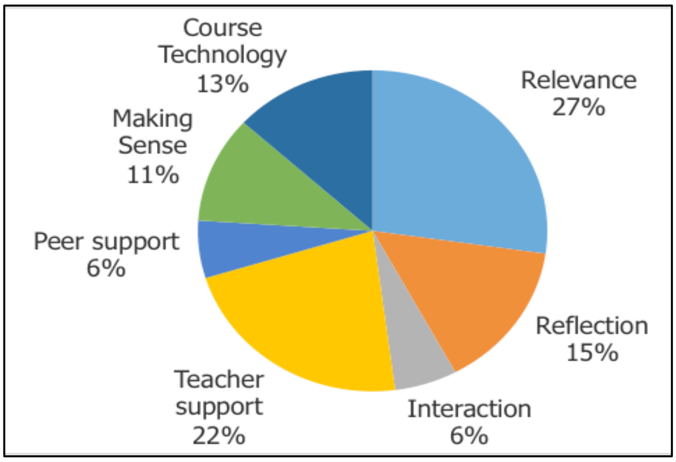


Figure 4.25: **The comparison between feedback of 7 parts from survey one and survey two (DSA stage three, unit two)**

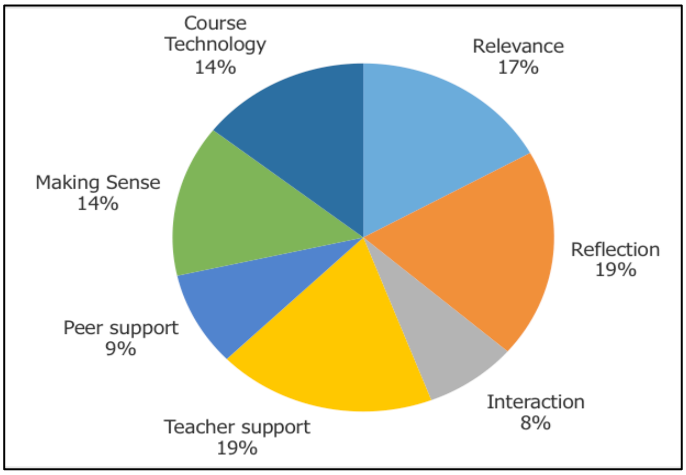
The comparison between the feedback from online survey one and online survey two is shown in Figure 4.25, which shows that at the end of semester, students found that both course technology and teacher support are important for making sense of communication. Moreover, relevance for professional practices and interaction were slightly decreased while peer support and reflection for critical thinking were slightly increased.

Unit three

The response rate received was 46% of student population (n=21) for the online survey one and 24% of student population (n=11) for the online survey two.



(a) Survey one responses



(b) Survey two responses

Figure 4.26: **The comparison between survey one and survey two responses (DSA stage three, unit three)**

Students were similarly asked to rate their response to 32 statements of 7 parts. From the online survey one, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.26 (a)): Interestingly, most respondents have their learning experiences influenced by relevance of professional practices (27%). Next, teacher support (22%) influenced learning experience. The influences of making sense of communication (11%), course technology (13%) and reflection (15%) on students' learning experience are closely. The factors of least influence on students' learning experience were peer support (6%) and interaction (6%).

From online survey two, in the scale of influence 'almost always' according to students' learning experience (see Figure 4.26 (b)) interestingly most respondents have their learning experiences influenced by reflection (19%) and teacher support (19%) together with relevance of professional practices (17%). Course technology (14%) and making sense of communication (14%) influenced learning experience the same. The factors of least influence on students' learning experience were peer support (9%) and interaction (8%).

At the end of semester, using course technology increased while teacher support decreased as same as the unit two. Also, peer support was increased while students had more interaction. Moreover, students worked together by supporting of reflection and making sense for communication as well.

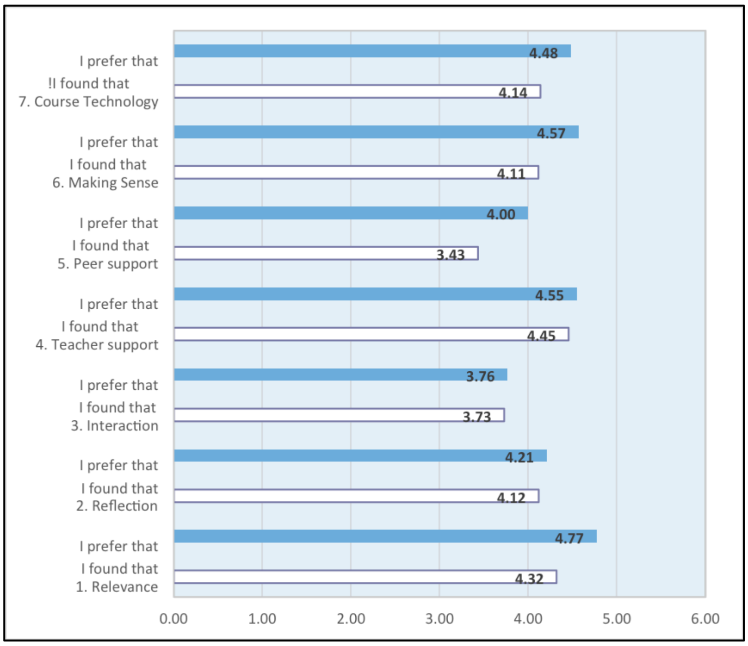


Figure 4.27: **The comparison between 'preference' (I prefer that) and 'feedback' (I found that) of 7 parts from survey two (DSA stage three, unit three)**

The difference of 7 factors from the online survey two is compared in Figure 4.27. It can be seen that the learners preferences all rated higher than what they believed they had experienced during the course. The highest average score of preference is relevance (4.77) together with the next three highest average score of making sense (4.57), teacher support (4.55), and course technology (4.48). Also, the feedback of teacher support is the highest average score (4.45). The lowest average score of feedback are interaction (3.73) and peer support (3.43).

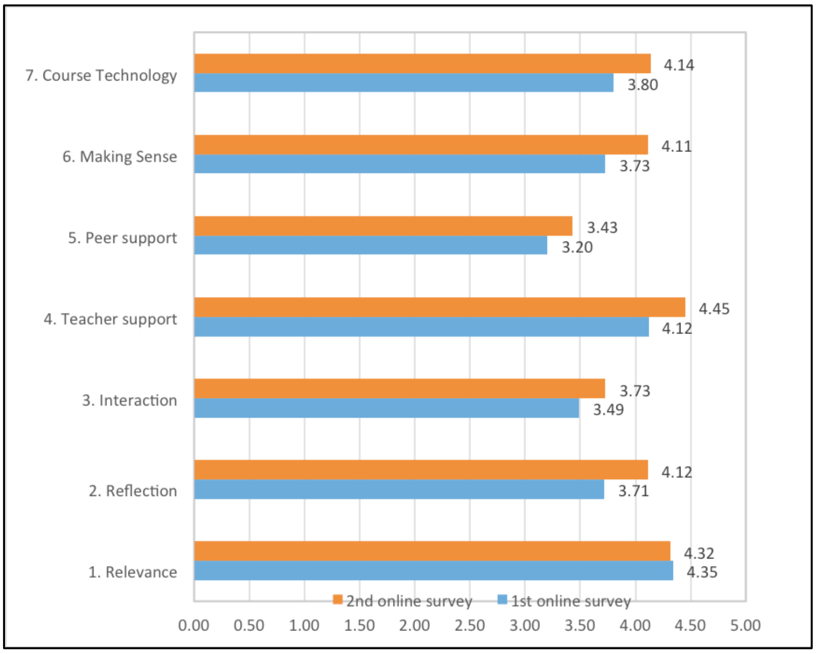


Figure 4.28: **The comparison between feedback of 7 parts from survey one and survey two (DSA stage three, unit three)**

The comparison between the feedback from online survey one and online survey two is shown in Figure 4.28, which shows that at the end of semester, students found that teacher support and relevance for professional practices are important together with using course technology to support reflection and making sense of communication. Moreover, peer support and interaction were increased.

According to the results of the descriptive spreadsheet analysis in last stage (testing redesigned unit), students were encouraged to interact with each other as peer support together with the support of teaching team and used course technology. They realized that their relevance for professional practices could be done by reflection and making sense of communication.

4.4 Factor Analysis (FA)

4.4.1 FA stage one

Unit one survey one

The full set of data analysed in this section can be found in Appendix F. According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor.

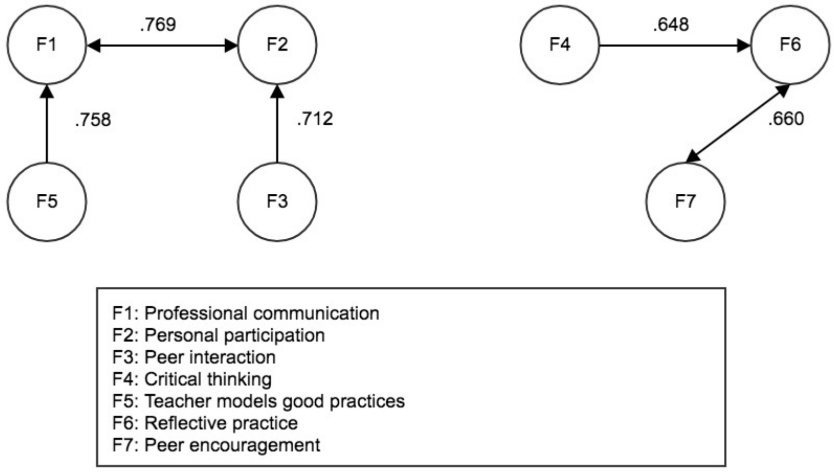


Figure 4.29: **7 factors from FA stage one, unit one, survey one**

From figure 4.29, the 7 factors from the online survey one (unit one) in stage one are shown. Understanding for communications between students and student with teacher influences participation. Students' sharing their own ideas also influences their participation. Students also started to come together as personal participation was influenced by professional communication. Teacher models good practices impacted on professional communication while critical thinking impacted on personal participation. Students thought critically how to support each other for improving their critical thinking. Moreover, peer encouragement was about how to engage peers for communication and interaction.

Factor no.	Name or theme of factor	List of questions	Information
F1	Professional communication	27, 28, 31, 26, 30, 32, 2, and 3	Good understanding for communication between student–teacher and student-student together with teacher support. Students realize the importance of professional practice and learn how to develop it. Technology is one important part for supporting learning and learning activities.
F2	Personal participation	21, 11, 29, 23, and 4	Students learn and appreciate the interaction with other students with professional practice as they need to think seriously about how to motivate or engage others to get involved for further developing their learning experience. Also, technology contributes greatly for interaction occurrence.
F3	Peer interaction	14, 15, 13, 12, and 22	Students' interaction are influenced by asking, responding, and sharing of their own ideas together with praising for others' contribution.
F4	Critical thinking	9, 10, and 8	Students' critical thinking can be supported by sharing and engagement their own ideas or experiences with each other. Moreover, reading is also important for critical thinking about their ideas.
Critical thinking is defined as having the ability to be supported by not only sharing but also engagement between peers			
F5	Teacher models good practices	20, 19, 17, and 18	Students are supported by teacher's modelling of critical self-reflection and good discourse. Also, teacher encourages students' critical thinking and participation.
F6	Reflective practice	6, 5, and 7	Students are trying to find the way to support their critical thinking and their learning including other students' ideas. It seems that students would like to engage to support their learning and thinking.
Reflective practice (component of critical thinking) is defined as having the engagement to support learning and thinking			
F7	Peer encouragement	24, 16, 1, and 25	Students have self-reflection to take responsibility for interaction and communication with other students based on their issues of interest. However, other students understand their struggle for learning.

Unit one survey two

The full set of data analysed in this section can be found in Appendix F. According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor.

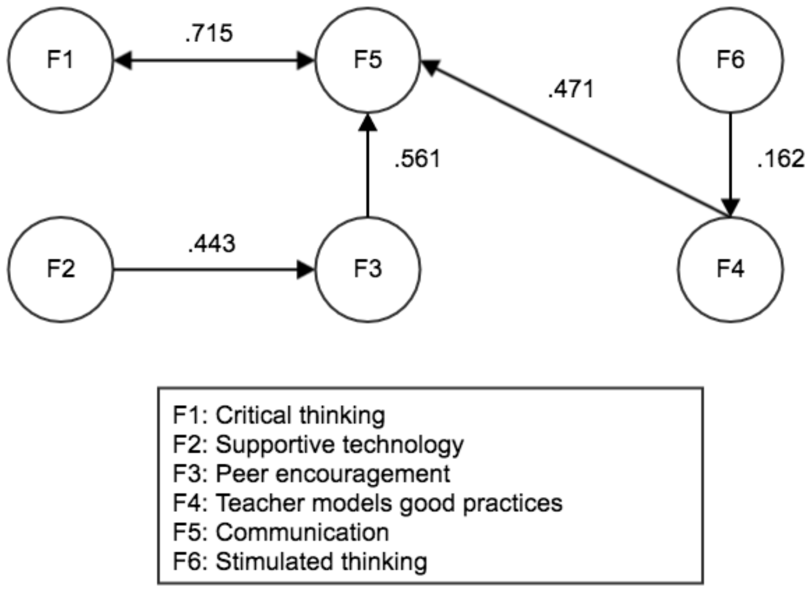


Figure 4.30: **6 factors from FA stage one, unit one, survey two**

From figure 4.30, the 6 factors from the online survey two (unit one) in stage one are shown. Six factors were shown the dependency of student, technology, and teacher at the end of semester. Communication and Critical thinking critically influenced each other. Peer encouragement is under the influence of supportive technology when students would like to explain their own ideas based on their understanding. In addition, the teacher can stimulate students' thinking for communication as well.

Factor no.	Name or theme of factor	List of questions	Information
F1	Critical thinking	4, 3, 8, 10, 6, 2, 1, 12, 5, 9, 7, 11, 16, 15, and 13	Personal reflection for being able to think critically requires the development of professional practice. Each student must be responsible for interacting with others together with understanding the ideas of self and others.
F2	Supportive technology	29, 28, 31, 27, 32, and 30	Technology is used for supporting students' learning by encouraging students' participation and improving learning activities. This is in order to develop students' learning experience. However, students and teacher also make good sense of their message with each other.
F3	Peer encouragement	23, 22, 24, 21, and 26	Students need support from other students by receiving praises and values for their contribution. Moreover, they would like somebody else understand their effort to learn with good communication.
F4	Teacher models good practice	20, 18, and 19	Teacher is able to support students by encouraging their participation. Modelling of both discourse and critical self-reflection is also helpful for students.
F5	Communication	14, and 25 (negative)	Communication with ideas explanation is very significant for students to understand with each other. Without interaction, students are not able to make good sense of their messages.
F6	Stimulated thinking	17	Students are able to improve their thinking by teacher's stimulation.

According to the results of the factor analysis in stage one, students were required to learn online. Although students had their own opinions, they had not experienced and unfamiliar online learning.

At the beginning of semester, students seemed to be independent of technology and teacher. Teaching team was extremely important to encourage students interested in self-learning and interaction with each other through online.

At the end of semester, the relationship among students, teacher and technology was more clearly. The feedback from the students has increased relied on peer support and important technology for increasing the relationship between students. Moreover, the teaching team was able to understand the ideas of students and encouraging students to share their learning experiences with each other.

4.4.2 FA stage two

It has been shown that the relationship of interaction between students in the discussion board on MyLO from two units is as follows:

Unit one survey one

The full set of data used to inform discussion this section can be found in Appendix G. According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor.

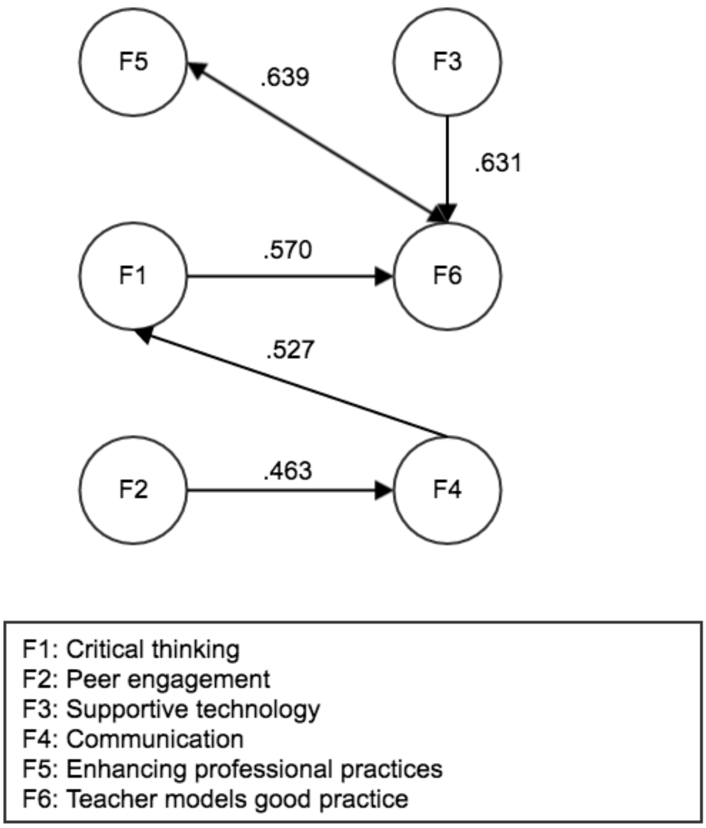


Figure 4.31: **6 factors from FA stage two, unit one, survey one**

From figure 4.31, the 6 factors from the online survey one (unit 1) in stage two are shown. Six factors were shown the dependency and connection among student, technology, and teacher at the beginning of semester. Enhancing professional practices influenced by teacher models good practice that influenced by supportive technology. Critical thinking is also influenced by good communication that influenced by peer engagement.

Factor no.	Name or theme of factor	List of questions	Information
F1	Critical thinking	6, 5, 10, 7, 9, 8, 11, and 16	Students have their critical thinking, they are able to express their own opinions and exchange their ideas with others' ideas together with giving the comments from the readings. As well as making themselves ready to interact and motivate others, this can contribute greatly to the development of their learning experience.
F2	Peer engagement	22, 23, 21, 15, 14, 13, and 24	The interaction between students is related very closely with peer support. When students get motivated, praised, and appreciated for the comments with explaining their own opinions, somebody else understand their effort and willingness to learn for further responding any feedback to their ideas' expression.
F3	Supportive technology	30, 31, 32, 29, and 17	Students can develop learning experience through technology-supported learning activities by encouraging interaction between students. Importantly, teacher uses appropriate technology for stimulating student's thinking.
F4	Communication	27, 28, 26, and 25	Communication between student-student and teacher-student can be implemented successfully, each posted message must be understood by each other. Both teacher and student will have good sense of communication, if they are able to comprehend what the meaning of transmitted messages are.
F5	Enhancing professional practices	3, 4, 2, and 1	Developing professional practices of students is based on their learning to understand what they are interested. The connection between learning and professional practice is very significant.
F6	Teacher models good practice	20, 19, 18, and 12	Teachers can support students to explain their ideas to others by encouraging students to interact with each other. The guidelines of good discourse and critical self-reflection are also modelled.

Unit one survey two

The full set of data used to inform discussion this section can be found in Appendix G. According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor.

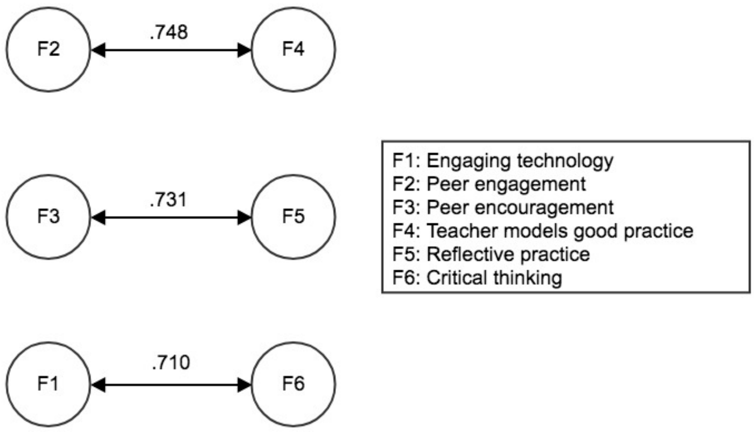


Figure 4.32: **6 factors from FA stage two, unit one, survey two**

From figure 4.32, the 6 factors from the online survey two (unit 1) in stage two are shown. There are three independent groups of factors at the end of semester. First of all, if teacher models good practices, students and their peer are actually happier and willing to do engagement with each other. Next, students have critical thinking about how they encourage their peers to learn and engage with them. Lastly, technology allows students to engage with each other in an online environment easily and students' are able to think critically about the information easily supplied by the technology that they are working with.

Factor no.	Name or theme of factor	List of questions	Information
F1	Engaging technology	2, 32, 30, 31, 27, 4, 25, 29, 9, 28, and 1	Once students have learned in their self-interest to make the development of professional practice, they must think critically how to share or exchange their own ideas or experiences with others. During communication, they must understand others' messages that are sent by fellow students or teachers. Teachers also need to understand students' messages. These are supported by technology for interaction and learning activities for further improving students' learning experience.
F2	Peer engagement	11, 14, 10, 13, 16, 15, and 12	Critical thinking allows students to work together with others energetically for engaging, sharing and exchanging their own ideas and experiences along with understanding the thoughts and experiences of others. At the same time, the interaction with others by their own sense of willing accountability has significantly contributed to understand their own ideas by others. Also, others can interact and ask them for clarification.
F3	Peer encouragement	21, 24, 7, 23, 26, and 3	Students who receive sympathy and support from other students by interaction and understanding of their barriers to learning, they are able to develop their professional practice and critical thinking about the idea or the experience of others. In addition, it is great that other students communicate them with understanding of their messages and appreciating their contribution.
F4	Teacher models good practice	19, 18, 20, 17, and 6	Teachers are extremely important to encourage students to express their own opinions and interact with others. Students also think critically about their own ideas. Moreover, teachers will model good discourse and critical self-reflection to guide students to follow.
F5	Reflective practice	5 and 22	Students are thinking critically about how they learn. Importantly, other students praise their contribution.
Reflective practice (component of critical thinking) is defined as having the awareness of praising your own contribution			
F6	Critical thinking	8	Critical thinking about ideas in the readings is a reflection by students.
Critical thinking is defined as having the ability of reflection on the readings			

The comparison between survey one and survey two from FA stage two unit one show that students are starting to engage and model practices demonstrated by the teacher. They start to leave messages and learning with each other. As they engage and communicate more and more, they share more and more together and start thinking about and engaging with each other more and more. At the beginning of semester, peer engagement is isolated from the teacher. At the end of semester, peer engagement and teacher models good practice are the most significant factors (.748). This means students are thinking what teacher shows them to engage with each other (.731). Also, technology is the least important for peer engagement (.710).

Unit two survey one

The full set of data used to inform discussion this section can be found in Appendix G. According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor.

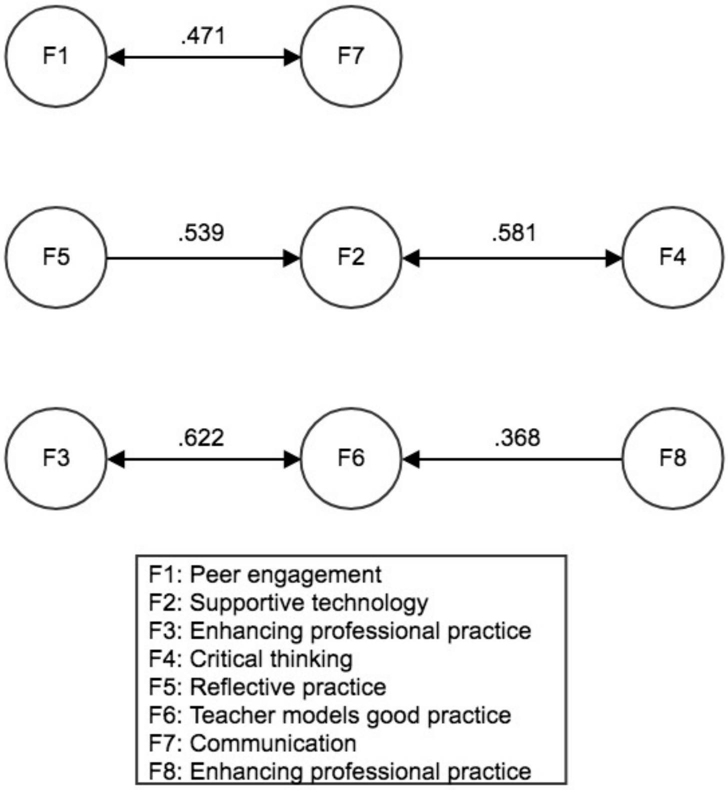


Figure 4.33: **8 factors from FA stage two, unit two, survey one**

From figure 4.33, the 8 factors from the online survey one (unit 2) in stage two are shown. There are three independent groups of factors at the beginning of semester. First of all, peer engagement and communication influenced with each other. Peers had more engagement when they communicate better together. Next, critical thinking impacted supportive technology. It was about how each student learns and it was more about individual idea and how they got their mind to change information. Moreover, technology allowed the students to get the readings and to think about how they were learning. However, they interacted more with the content and did not interact as much with each other. It seems that they did everything in almost isolation. They were thinking critically about how they shared their own ideas and thinking about other students' ideas. Moreover, they thought how they used technology by themselves and how to interact with their peers. Obviously, first year students in this unit were thinking more about how they interacted with technology and less about how they should interact with their peers. Finally, students' enhancing professional practices were done through modelling of good practices by the teacher. It was about what students learnt from their professional practices and they recognised what is going on with the teaching team, by interacting with teacher, and also looking what teacher was doing. They were thinking how to bring to their own professional practices and enhance themselves. Moreover, they were understanding that it was important to learn. Also, teacher models good practices in an effort to encourage students to participate and also stimulate their thinking.

Factor no.	**Name or theme of factor**	**List of questions**	**Information**
F1	Peer engagement	22, 23, 15, 21, 26, 14, 13, 24, 12, and 16	Other students can support students by admiration and appreciation for the contribution of the students, as well as interactive feedback to students. Also, encouraging interaction between them with making good sense of any message and understanding with each other are supportive ways by peers. In addition, each student can ask questions for better understanding each other's opinions along with understanding in students' effort to learn. The students also have a sense of responsibility and duty to interact with other students.
F2	Supportive technology	32, 30, 31, 29, and 11	Technology supports students by improving their learning activities, helping them how to learn, and developing their learning experience together with motivation to achieve interaction. These deal with the active students who thinks critically and are engaging with other students to improve their learning experience.
F3	Enhancing professional practice	4, 3, 20, and 25	Students' learning makes good connection with their professional practices. Moreover, students learn how to develop professional practice and understanding the message of the other students. These are supported by teacher to model critical self-reflection.
F4	Critical thinking	1, 9, 7, and 10	Students' learning is related to their interests. They have thought deeply on sharing their own ideas or experiences to others together with understanding others' ideas. In addition, they try to find the appropriate way to maintain engagement and intimate relationships with other students for exchanging ideas and experiences with each other.
Critical thinking is defined as being able to engage in relationships in order to exchange ideas and experiences			
F5	Reflective practice	8, 5, and 6	Students are thinking seriously about their ideas from the readings, their learning way, and showing their own ideas off.

Factor no.	Name or theme of factor	List of questions	Information
Reflective practice (component of critical thinking) is defined as having the ability to show your own ideas			
F6	Teacher models good practice	18, 19, and 17	Teachers support students by motivating for participation, modelling good discourse, and encouraging students' thinking.
F7	Communication	28, and 27	Understanding about student's messages and teacher's messages is important for good communication between teacher and student.
F8	Enhancing professional practice	2	Students' self-learning is considerable for their professional practice.

Unit two survey two

The researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor.

Because data from this survey had fewer than two cases, at least one of the variables has zero variance, there is only one variable in the analysis, or correlation coefficients could not be computed for all pairs of variables, there are no further statistics will be computed.

According to the results of the factor analysis in stage two, at the beginning of semester, students wanted to learn for developing their professional practices. The intimacy of relationship between student-student and student-teacher are different. This influenced the responsibility to interact differently. In addition, students' professional practices relied on their self-learning and communication. At the end of the semester, students developed their professional practices by the requirement of specific reading skill for making relationship and interaction between students. Moreover, students should realize the effective understanding and encouraging each other to think critically for professional practices.

4.4.3 FA stage three

It has been shown the relationship of interaction between students in the discussion board on MyLO from two units as follows:

Unit three survey one

The full set of data used to inform discussion this section can be found in Appendix H. According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor.

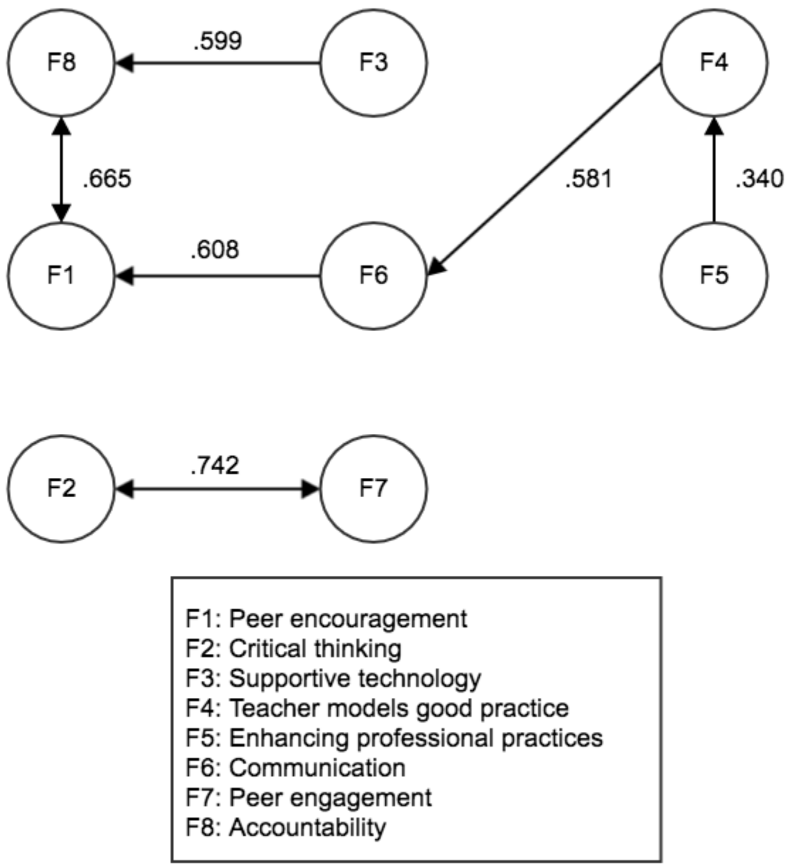


Figure 4.34: **8 factors from FA stage three, unit three, survey one**

From figure 4.34, the 8 factors from the online survey one (unit 1) in last stage are shown. There are two independent groups of factors at the beginning of semester. Teacher needs to have a good personality, ethical moral stands, and should prepare and demonstrate good practices for students. Enhancing professional practices were done by the teacher modelling good practices, impacting on communication and encouraged by peers that were being well supported by technology. Significantly, students had their moral awareness and become accountable to themselves and to their peers about how they use technology for interaction with their peers. They felt applicable to learn online and they felt how they should be done.

Mature students were doing assignments for the postgraduate course. They were thinking much more deeply and much more sincerely about what they were doing and how they interacted with other students. They had high level of understanding and how to think to communicate with other students. They did everything independently and they had capacity to think very deeply what it was going on.

Factor no.	Name or theme of factor	List of questions	Information
F1	Peer encouragement	15, 21, 23, 22, 24, 20, 14, 13, and 17	Students' interaction are influenced by asking, responding, and explaining of their own ideas with each other. They need support from other students by receiving praises and values for their contribution together with participation and understanding their effort to learn. In addition, they are able to improve their thinking by teacher's stimulation and modelling of critical self-reflection.
F2	Critical thinking	6, 9, 8, 7, 5, and 11	Students have their critical thinking, they are able to express their own opinions and exchange their ideas with others' ideas together with giving the comments from the readings. They are active and engaged with other students for improving their learning experience.
F3	Supportive technology	29, 30, 31, and 32	Technology is used for supporting students' learning by encouraging students' participation and improving learning activities. This is in order to develop students' learning experience.
F4	Teacher models good practice	18, 19, and 28	Teacher is able to support students by encouraging their participation and modelling good discourse. In addition, teacher also makes good sense of students' messages.
F5	Enhancing professional practice	2, 4, 3, and 1	Developing professional practices of students is based on their learning to understand what they are interested. The connection between learning and professional practice is very significant.

Factor no.	Name or theme of factor	List of questions	Information
F6	Communication	25, 26, and 27	Students' communication can be implemented successfully when each posted message can be understood by each other. In addition, students also make good sense of the teacher's messages
F7	Peer engagement	10 and 12	Students think critically for engagement with other students' ideas or experiences. Also, they explain their ideas to other students.
F8	Accountability	16	Students take responsibility for interaction with other students.

Unit three survey two

According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor (see Appendix H).

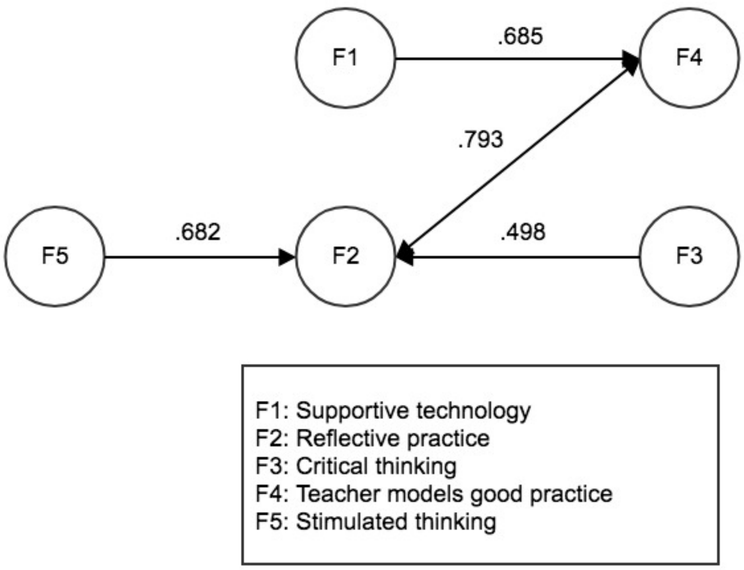


Figure 4.35: **5 factors from FA stage three, unit three, survey two**

From figure 4.35, the 5 factors from the online survey two (redesigned unit 3) of semester 1 year 2016 are shown. The teaching team was able to support students' learning based on students' interest. Students enrolled in this unit because they would like to be there. They thought critically about how they learn, how they shared their own ideas, and how they engaged with other students for further improving their learning experiences. Enhancing professional practices encouraged participation and messaging communication through supportive technology with modelling of good practices by teacher.

Factor no.	Name or theme of factor	List of questions	Information
F1	Supportive Technology	2, 3, 4, 21, 25, 26, 28, 29, 30, 31 and 32	Technology is used for supporting students' learning by encouraging students' participation and improving learning activities. This is in order to develop students' learning experience. Students realize the importance of professional practice and learn how to develop it. In addition, students and teacher also make good sense of their message.
F2	Reflective practice	5, 6, 9, 10, 11, 12, 13, 16, 18, 22, 23 and 24	Critical thinking allows students to work energetically with others for engaging, explaining, and sharing their own ideas and experiences. Also, students feel accountable to interact with each other together with admiration and appreciation for their contribution.
Reflective practice (component of critical thinking) is defined as having the ability to interact and appreciate your contribution			
F3	Critical thinking	7, 8, 14, and 15	Students' interaction is influenced by other students' ideas explanation and responses. Moreover, students have their critical thinking about other students' idea from reflection on the readings.
Critical thinking is defined as having the ability to understand others' ideas			
F4	Teacher models good practice	19, 20, and 27	Teacher is able to support students by modelling of both discourse and critical self-reflection together with making good sense of teacher's message.
F5	Stimulated thinking	1 and 17	Teacher can support students' learning based on their interest

Unit two survey one

The full set of data used to inform discussion this section can be found in Appendix H. According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor (see Appendix H).

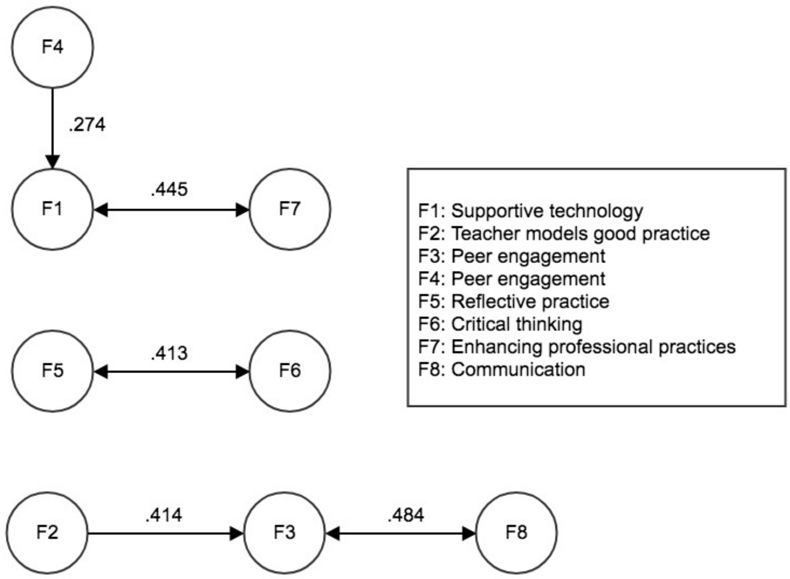


Figure 4.36: **8 factors from FA stage three, unit two, survey one**

From figure 4.36, the 8 factors from the online survey one (unit 2) in last stage are shown. There are three independent groups of factors at the beginning of semester. First of all, technology was influenced by enhancing professional practices and peer engagement. Next, students knew how they learnt and how they engaged with people. Also, they were thinking how they were doing. Finally, all was about the communication. Teacher models good practices influenced peer engagement. Students knew how they learnt and shared their own ideas for further communication with their peers. This is good form of communication process.

Factor no.	Name or theme of factor	List of questions	Information
F1	Supportive technology	32, 31, 29, and 30	Technology is used for supporting students' learning by encouraging students' participation and improving learning activities. This is in order to develop students' learning experience.
F2	Teacher models good practice	20, 19, 18, and 17	Students are supported by teacher's modelling of critical self-reflection and good discourse. Also, teacher encourages students for thinking and participation.
F3	Peer engagement	22, 23, 21, and 24	Students need support from other students by receiving praises and values for their contribution. Moreover, they would like somebody else understand their effort to learn.
F4	Peer engagement	14, 15, 12, and 13	Students' interaction are influenced by asking, responding, and explaining of their ideas with each other.
F5	Reflective practice	7, 6, 5, and 8	Students are thinking seriously about their ideas from the readings and their learning way. Also they are showing and sharing their own ideas with each other.
Reflective practice (component of critical thinking) is defined as having the awareness of serious thinking required for sharing your own ideas			
F6	Critical thinking	9, 10, 11, and 16	Students think critically to express and exchange their own ideas with each other for improving their learning experience. They are also ready to interact with other students.
Critical thinking is defined as having the ability to exchange your own ideas in order to interact with each other			
F7	Enhancing professional practices	2, 4, 3, and 1	Developing professional practices of students is based on their learning to understand what they are interested. The connection between learning and professional practice is very significant.
F8	Communication	25, 27, 26, and 28	Communication between student-student and teacher-student can be implemented successfully, each posted message must be understood by each other. Both teacher and student will have good sense of communication, if they are able to comprehend what the meaning of transmitted messages are.

Unit two survey two

According to the last step of Exploratory Factor Analysis (step 5 of interpretation and labelling), the researcher did the analysis by examining which variables are attributable to a factor, and then identifying the most appropriate name for each factor (see Appendix H).

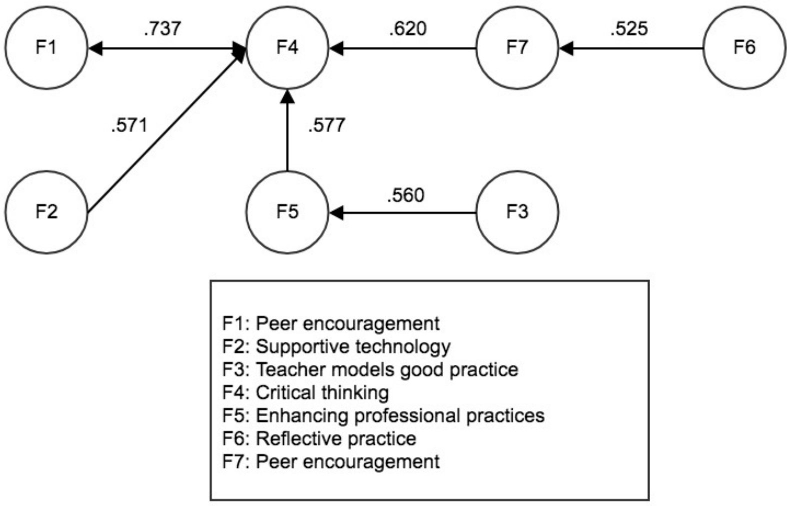


Figure 4.37: **7 factors from FA stage three, unit two, survey two**

From figure 4.37, the 7 factors from the online survey two (unit 2) in last stage are shown. In order to be successful in online learning, not only due to assistance of a teaching team, but also the students need to exchange their own ideas and experiences with each other. Teacher models good practice for enhancing professional practices and then further improving students' critical thinking. Also, technology and peer encouragement impacted students' critical thinking. Moreover, students had critical thinking about how to come together.

<table>
<tr><th>Factor no.</th><th>Name or theme of factor</th><th>List of questions</th><th>Information</th></tr>
<tr><td>F1</td><td>Peer encouragement</td><td>21, 22, 23, 13, 14, and 15</td><td>The interaction between students is related very closely with peer support. When students get motivated, praised, and appreciated for the comments with explaining their own opinions, and responding any feedback to their ideas' expression.</td></tr>
<tr><td>F2</td><td>Supportive technology</td><td>26, 27, 28, 29, 30, 31, and 32</td><td>Technology is used for supporting students' learning by encouraging students' participation and improving learning activities. In addition, students' communication can be implemented successfully together with making good sense of the teacher's messages. This is in order to develop students' learning experience.</td></tr>
<tr><td>F3</td><td>Teacher models good practice</td><td>17, 18, 19, and 20</td><td>Students are supported by teacher's modelling of critical self-reflection and good discourse. Also, teacher encourages students for thinking and participation.</td></tr>
<tr><td>F4</td><td>Critical thinking</td><td>10, 11, 12, 16, and 25</td><td>Students think critically for students making themselves ready to interact and explain their own ideas with other students. This also improves their learning experience.</td></tr>
<tr><td colspan="4">Critical thinking is defined as having the awareness of your own thinking abilities that you are using to improve your learning experience</td></tr>
<tr><td>F5</td><td>Enhancing professional practices</td><td>1, 2, 3, 4, and 9</td><td>Developing professional practices of students is based on their learning to understand what they are interested. In addition, students think critically to exchange their own ideas with each other. The connection between learning and professional practice is very significant.</td></tr>
<tr><td>F6</td><td>Reflective practice</td><td>5, 6, 7, and 8</td><td>Students are trying to find the way to support their critical thinking and their learning including other students' ideas. It seems that students would like to engage for supporting their learning and thinking. Also, critical thinking about ideas in the readings is a reflection of students.</td></tr>
<tr><td colspan="4">Reflective practice (component of critical thinking) is defined as having the abilities to not only engage but also to justify the ideas in the readings that you are using to support your own learning and thinking</td></tr>
<tr><td>F7</td><td>Peer encouragement</td><td>24</td><td>Other students understand students' effort to learn.</td></tr>
</table>

According to the results of the factor analysis in the last stage (testing redesigned unit), at the beginning of semester, students still see the importance of professional practices and they realised that developing their learning experience is based on critical thinking and with information clearly explained. Moreover, the interaction between students was good depending on good communication and interaction being their own responsibility. After students understood and were accountable to interact and communicate with each other, they thought critically for sharing their own ideas or learning experiences by technology-supported with modelling good practices by teaching team.

It can be found that students have their learning experiences influenced by intrinsic improvement of their 'critical thinking' and extrinsic improvement derived from others 'reflective practice'. Importantly these two different factors can be clearly distinguished to understand which factor has a greater influence and which has less influence on the development of learning experiences. Reflective practice highlights that students are able to support their peers by engagement, awareness of contributions, sharing their own ideas, interaction, awareness of thinking, and engagement with idea justification.

Significantly, students gain learning experiences of different types through both critical and reflective practice. Critical thinking can be understood as the ability to transfer knowledge learned in the online environment, and it is improved by students' course participation with critical thinking as an essential element (Bronson 2008). In addition, critical thinking influences students' learning progress and continuous learning (Kim 2009). Reflective practice can be understood as the cognitive processes by which each student-participant takes responsibility for his/her own learning, becomes aware of his/her learning goals, and recognises they are part of a learning process (DEMİRALP & Hilal 2012). Combined, these cognitive processes encourage collaboration amongst those involved in the learning process. By using their positive ideas, students can optimise the effectiveness and productivity of results from teamwork (DUBAN & YELKEN 2010). Importantly, reflective practice consists of seeking what literally is occurring to students and around them, seeking to become aware of what is occurring more subtly around them and within them, and seeking to account for any behavioural or attitudinal changes in themselves and others (Baldwin & Williams 1990; Schön 1987).

For example, at the beginning of the semester, a student worked on individual assignments without interactions. The work is just only for himself/herself. After that, all students must work together on the group assignment by posting, questioning and commenting through discussion boards. By the end of the semester, students have been thinking critically about self-responsibility and have reflective practice to communicate and interact to others as well. Reflective practice with others is able to encourage continuous communication in the delivery of same topics of interest (Rodgers 2002). Finally, critical thinking and reflective practice are key skills for sustainable improvement in higher education organization (Dawe, Jucker & Martin 2005).

4.5 Comparison of the contributions of three quantitative data analysis approach

The first quantitative data analysis approach was the use of the discussion board data to create social network diagrams for demonstrating students' social interaction at the beginning and end of semester. The diagram consisted of the connection between individuals, the direction, and the type of communication (student-student or student-teacher). The frequency of interaction was presented how students communicated with each other.

The analysis of the discussion board data produced a number of both two-way and one-way interactions between the research participants. Students who had the same topics of interest, they interacted two-way interactions by encouragement of each other. For one-way interaction, although students might have different interest and were not interested to post, they were changed their minds by others' being reposted again. Also, the social network diagrams indicated the social connections of the research participants changed over the 2 years period of the research study. Although there were differences in the number of students and the diversity of group works, the social connections were still presented all semester based on mandatory assignment tasks. There was specific evidence that it was interesting to encourage some students serving as hubs or centres of learning without teaching team that could be one way to engage or encourage continued peer learning with sharing learning experience in an online environment.

The second quantitative data analysis approach was the use of the online survey data to create a series of descriptive statistics as bar and pie graphs that were designed to give an overview of the student participants in the beginning and the end of semester from three educational units. This approach gave detail about the student participant in relation to their study, peer learning activities with interaction, using technology, and supported by the teaching team in an online environment. The reflection, relevance, and making sense also were considered.

The analysis of online survey data with descriptive statistics produced the preferences and feedback of students during their studying together. Supporting by technology and the teaching team was significant for improving students' learning experience according to result in last stage of testing redesigned unit. However, orientation to learning was one of important element for students who studied peer learning in online environment because their understanding of importance of technology-supported peer learning activities encouraged them to reflect and make sense of communication with each other.

The last quantitative factor analysis approach was the use of the online survey data to observe related factors in the beginning and the end of semester. Significantly, the strength of relationship between factors from the analysis of the data from the redesigned unit was considered to improve the student learning experience.

The analysis of online survey data by covariate factor analysis evidenced relationships in terms of factors according to students' studying together in an online environment. For students who studied online, the advancement of learning and the development of learning experience depended on the responsibility of the students themselves to understand the importance and functions assigned to interact with each other. The teaching team played an important role as intermediaries by encouraging students to express their own opinions and by the use of technology as an important tool. The supportive technology had to meet the needs of students with different topics of interest, various levels of attention, and diversity of convenient learning times.

Overall, the three approaches: social network analysis; descriptive spreadsheet analysis; and factor analysis; created a better understanding of the factors influencing and impacting the student learning experience in the context of peer learning in an online environment. By using these three separate approaches to analyse the collected quantitative data, each was able to provide an important aspect of understanding what was happening in the online space. The social network analysis created students' social interaction. The descriptive spreadsheet analysis provided an overview of students' learning experiences according to relevance, reflection, interaction, teacher support, peer support, making sense, and course technology. And the factor analysis provided weighted influences impacting the student experience.

4.6 Chapter summary

This chapter presented the results of the quantitative data analysis of the research data collected by the online survey and discussion board. There were three different analysis approaches used and each was presented individually and independently. These three approaches included social network analysis; descriptive spreadsheet analysis; and factor analysis.

The social network analysis was created using social network diagrams that showed the social interaction between participant at the beginning and end of semester. The diagrams were in relation to each time period showing the connections including one-way interaction and two-way interaction. Also, participants who still communicated and interacted during time period were presented as well.

The descriptive spreadsheet analysis was created using the bar and pie graphs that showed the changing of students' learning experience including their preference and feedback. These were presented at the beginning and end of semester showing the influences of some aspects including relevance, reflection, interaction, teacher support, peer support, making sense, and course technology.

The factor analysis was created and the related factors that showed the influences with each other at the beginning and the end of semester. The strength of relationship between some factors was presented for considering how to improve students learning experiences accordingly.

Chapter 5: Qualitative Data Analysis and Results

5.1 Introduction

This chapter describes the qualitative analysis of collected data using the methodology presented within chapter three. There are two sets of collected qualitative data: the semi-structured interview data by teaching team and the focus group data by students. As described in chapter three, data analysis was done in 3 stages (3 semesters) case study of three educational units. Analysis of the first two stages was conducted and informed unit design suggestions before a confirmatory analysis of last stage data on the redesigned unit.

This chapter is divided into the following sections:

- Section 5.2 describes interview data analysis stage one. The data was analysed using thematic coding. The section presents the outcome from the anaylsis of the interviews with teaching team as 12 themes.

- Section 5.3 describes focus group data analysis stage one. The data was analysed using thematic coding. This section presents the outcome from the analysis of focus group with students in term of 1 more theme.

- Section 5.4 describes interview data analysis stage two. The data was analysed using thematic coding. This section presents the results from interview with teaching team in terms of 2 more themes.

- Section 5.5 describes focus group data analysis stage two. The data was analysed using thematic coding. This section presents the outcome from the focus group with students as 14 themes (no more new theme).

- Section 5.6 describes interview data analysis stage three. Stage three is the confirmation analysis of suggestion strategies for redesigning two units for engagement of peer interaction and technology, and a further unit for confirmation. This section presents the outcome from interviews with teaching team as 19 themes.

- Section 5.7 describes focus group data analysis stage three. Stage three is the confirmation analysis of suggestion strategies for redesigning two units for engagement of peer interaction and technology, and a further unit for confirmation. This section presents the outcome from the focus group with students as 22 themes.

- Section 5.8 compares the themes from the three stages as described above.

- Section 5.9 summarises the outcomes and preliminary findings from the chapter.

5.2 Interview Data Analysis (IDA) Stage One

The inductive approach was used on stage one data by observing data in specific situations to create rules or general conclusions by working toward abstract concepts. Using the inductive approach does not determine how one interprets the coding. Thus, there were no preconceived notions of what the codes for the data would look like. It is important to ensure that the meaning of the data is captured in the coding. Taking an iterative approach to coding can ensure that the meaning behind the code is not lost (Gioia, Corley & Hamilton 2013; Thomas 2006). Bias in the coding was dealt with through research training with the supervisor, who examined a sample of the coding with the researcher before she completed the coding process. Predefined codes were not used and the accurate representation of codes was presented (Ní Dhiorbháin & Ó Duibhir 2017). It was important for stage one to use a bottom approach to ensure that coding process commenced with a grounded approach. The coding work was undertaken as follows.

From the raw transcript, the researcher separated lines of transcript and formulated a summary code for each line. The analytic process was carried out for open coding, including identifying concepts (open codes) for each summary code. In the process, duplicate open codes were deleted. Finally, the open codes were categorised into themes within the explicit meanings of data.

Table 5.1: An example of the coding process

Line	Raw transcript	Summary code	Open code	Deleting duplicated open code	Theme
L2	when we are interested in something we are more engaged,	Lecturer and students are more engaged when they are interesting in something	More engagement by lecturer and students' interesting	More engagement by lecturer and students' interesting	Intrinsic improvement
L3	we are more motivated.	Lecturer and students are more motivated when they are interesting in something	More motivation by lecturer and students' interesting	More motivation by lecturer and students' interesting	Extrinsic Improvement
L4	So, if you can relate something for example "oh wow, you know, I experienced this too!".	students who are interested something, they also experienced it	Students' experience by students' interesting	Students' experience by students' interesting	Student Experience
L5	Some of the students commented in the tutorial this week	Some students commented in the tutorial	Students' comment for tutorial	Students' comment for tutorial	Technology Affordances
L6	"wow I have been online for a couple of years now this is fantastic	Students have been connect online and feel fantastic	*Students' Interactive connection through online*	Students' Interactive connection through online	Communication Development
L7	it is great to now to be able to connect in an interactive way."	Students connect in an interactive way	*Students' Interactive connection through online*		
L8	Most have not been able to experience this before.	Most students have not been able to experience interactive way before	Non interactive experience before for most students	Non interactive experience before for most students	Student Experience

This section will present the findings from the analysis of the semi-structured interviews. The interview analysis was conducted using Thematic Coding which is designed to identify the themes from the interview data. There are twelve themes from IDA stage one: community development, extrinsic improvement, facilitating thinking, intrinsic improvement, learning administration, learning mechanism, pedagogical preparation, skills development, student experience, teaching condition, technology affordances, and virtual implementation.

The data analysis was conducted using thematic coding, coding is the meaningful process that data is condensed into categories. Then themes are identified by summarizing each piece of data within the explicit meanings of data. To understand more clearly, positive aspects and negative aspects from group of open codes are shown for each theme. An example of coding is shown in Table 5.2. (see Table 5.2, full detail is in appendix I)

Table 5.2: Example of positive aspects and negative aspects of some themes from IDA stage one

Theme	Positive aspects	Negative aspects
Community Development	• *Collaborative group* • *Sense of participation* • *Challenging by peers* • *Supportive channels*	• *No society engagement* • *Ineffective communication* • *Confrontation with ideas discussion* • *Insignificant motivation* • *Uncomfortable group learning*

5.2.1 Thematic Code – Community Development

Community Development is under the influence of the building of community activities and the relationship of participants. Small group working with right interaction is able to improve student-student communication. Also engaging by peers encouraged students' sharing ideas with each other.

Positive aspects for community development include collaborative group, sense of participation, challenging by peers, and supportive channels.

- *Collaborative group* is concerned that communication and reflection influenced by small group working, engagement, message and relationship between each other. Their right interaction with other students enriches their experience of interaction.

  "the interactions I am having with them ... students are working in small groups challenging each other's thinking *(from interviewee TA)"*

- *Sense of participation* is determined that students are willing to give opinion and respond feedback. Also, the interaction builds relationships and a sense of participation. In the meantime, tutors support students in building relationship with others.

  "give an opinion, or to respond, or to give feedback … willing to participate and the building of relationships that are so important *(from interviewee TB)"*

- *Challenging by peers* is explored by students being challenged by their peers when sharing their ideas together through confrontation. Learning from peers is similar to the way have children learnt.

  "the children learning they are social beings and they learn in that way, they learn lot more from their peers in many ways *(from interviewee TA)*"

- *Supportive channels* support the improvement of community. Using 'Collaborate' provide students' a comfortable environment when giving comments. However, some tutor uses email to answer students' questions.

"necessarily having to comment … that 'Collaborate' can do that *(from interviewee TC)* …

Negative aspects for community development include no society engagement, ineffective communication, confrontation with ideas discussion, insignificant motivation, and uncomfortable group learning.

- *No society engagement* explores students' engagement and how it influences their professional development. However, some students do not engage with other students.

  "where society is moving to and your views can then become outdated … if you had not engaged in professional development *(from interviewee TB)"*

- *Ineffective communication* relates to some students who are not good in communicating and both teacher-teacher communication and student-student communication are varied.

  "fixed way of communicating varies from teacher to teacher and student to student … no way of checking that message along the way *(from interviewee TC*)"

- *Confrontation with ideas discussion* relates to students who are confronted with ideas through discussion. Students make relationship based on their expectations of how their opinions are valued.

  "relationship with someone because just meeting someone you have never met before and expecting them to value their opinion *(from interviewee TB*)"

- *Insignificant motivation* relates to students who would lose motivation for engagement when they did not receive any responses. Online students lack the impetus to engage with other students' ideas.

  "Where if they're not receiving any responses, … that they would lose motivation to be engaged … there's no impetus I think *(from interviewee TC*)"

- *Uncomfortable group learning* relates to the comfort for learning in groups. For group assignment, while other students are not engaged or motivated, students are frustrated when they have to cover for the lack of work of other students.

"they are not comfortable learning in groups … get grouped with other students who are not as engaged or motivated *(from interviewee TB*)"

5.2.2 Thematic Code – Extrinsic Improvement

Extrinsic Improvement is under the influence of any support by external parties including peer and teaching team (teacher or tutor). Obviously, motivation, engagement, feedback, and thinking with each other are important for extrinsic improvement.

Positive aspects for extrinsic improvement include significant teacher / tutor support, significant peer support, extrinsic motivation, reflective feedback, valuable thinking or ideas, and supportive channels.

- *Significant teacher / tutor support* relates to that tutors bring up and challenged good ideas for students. Students start to learn according to the plan together with clear simple word by tutors. Group of tutors work together step by step for planning, monitoring, and standing by students' response.

  "to support them through their learning … and make myself available…then you can challenge them *(from interviewee TB*)"

- *Significant peer support* is when students support other students as part of chain or learning circle of peers by sharing orientation stuff, being available, being open, and introducing themselves.

  "can do to support each other's learning is that … they can be a very important part in the chain *(from interviewee TC*)"

- *Extrinsic motivation* is when students who have extrinsic motivation, will have pressure placed on them to interact with others. As a tutor, it is important to encourage students' interaction.

  "those students it's that extrinsic motivation … As a tutor that's important and encouraging students … *(from interviewee TB*)"

- *Reflective feedback* is determined when teacher support students by encouraging them to interact constantly with others especially online. Tutors also have thought about interaction perspective and they gave feedback immediately.

  "need to learn how interactively … being responsive … thought about from this perspective … so immediately giving some feedback *(from interviewee TB*)"

- *Valuable thinking or ideas* is happens when students are comfortable with someone, they will respect others' opinions. They respond to other students' post for challenging their thinking and teacher supported them for their deep thinking.

  "actually value their ideas … If you are comfortable with someone, and you're willing to say ok I am going to respect your opinions *(from interviewee TB*)"

- *Supportive channels* are when teacher support students by either virtual tutorial or discussion board.

  "whether in the virtual tutorial or on the discussion board … planned to do *(from interviewee TA*)

Negative aspects for extrinsic improvement include insignificant peer support as following

- *Insignificant peer support* is when students are not able to support each other in different enviroments. For instance, they do not have the right tools or access.

  "Whether they weren't able to do that because it was so challenging and difficult for them from a distance I don't know*(from interviewee TA*)"

5.2.3 Thematic Code – Facilitating Thinking

Facilitating thinking is under the influence of any activity or ability for responding own thinking including sharing, engagement, and interaction according to making easier thinking.

Positive aspects for facilitating thinking include society for thinking, critical thinking with reflection, relationship between thinking and engagement, relationship between thinking and peer support, relationship between thinking and tutor support, and supportive channels.

- *Society for thinking* is explored that when distanced students involved in society, their thinking can be locked by society.

  “locked in and fixed thinking on society *(from interviewee TB)”*

- *Critical thinking with reflection* is shown that critical thinking and beliefs of teacher and students are influenced with each other. Critical thinking can be done by challenging others’ thinking in order to frame the appropriate questions.

  “focus on introducing deeper more challenging thinking which takes them from the reflection … in order to frame appropriate questions *(from interviewee TA)”*

- *Relationship between thinking and engagement* is explored when students are not engaging, then impact on students’ critical reflective thinking is very little. Engagement and interaction helps students to challenge and change their ideas.

  “well providing they’re engaging, online, I think there is an impact. If they’re not engaging, then there would be very little impact *(From interviewee TB)”*

- *Relationship between thinking and peer support* is explored when students can support their peer by challenging each other to develop their own thinking with willingness to contribute.

  “idea of being willing to contribute…contributing on and responding to people’s content whether it be online or face-to-face online *(From interviewee TC)”*

- *Relationship between thinking and tutor support* is explored when tutor tracks any changes according to students' thinking.

  “… with track changes, where you will question their thinking *(from interviewee TB”*

- *Supportive channels* are explored when students can challenge each other to develop their thinking through online ‘discussion board.

  “and they have already tested their thinking in a real time tutorial ...and, prior to this year, online on the discussion board *(from interviewee TA)”*

Negative aspects for facilitating thinking include insignificant thinking, and unthought posting.

- *Insignificant thinking* is presented when students do not challenge more deep thinking with their belief, then they do not really develop their reflective skills.

  "not being challenged to think more deeply about what they believe, then they are not going to actually develop those reflective skills *(From interviewee TA)"*

- *Unthought posting* is presented when students possibly post something online, then tutor is alerted the fact that they are not thinking.

  "they post something which alerts me to the fact that they are not thinking *(From interviewee TA)"*

5.2.4 Thematic Code – Intrinsic Improvement

Intrinsic improvement is under the influence of students' personality including accountability, belief, thinking, and learning experience for supporting and challenging students' learning in online environment.

Positive aspects for intrinsic improvement include significant accountability, valuable belief, personality distinction, significant thinking or idea, significant learning experience, and supportive channels.

- *Significant accountability* is shown when students take responsibility for their own learning and others' learning. They have mandatory accountability and personality for willing to put their opinions and interacting with each other.

  "as individuals have the responsibility … and so the intention of there is that by challenging others they are supporting each other *(From interviewee TA)"*

- *Valuable belief* is explored that is presented when everyone has the individual ownership of belief and a right of belief selection.

  "nobody else can change the way I believe, I can only change that myself, *(From interviewee TA)"*

- *Personality distinction* is shown when all students are different and they can offer distinct opinions.

  "all students are different ... offering a different opinion *(From interviewee TB)*

- *Significant thinking or idea* is shown when students feel safe, they are comfortable to express their opinions. Students' personality is one of the factor to stop their critical thinking. However, students have to think deeper into their own thinking based on their previous experience.

  "they are being asked to question,…really depends on their life experiences, their understandings, and then also of course their capacity *(From interviewee TA)"*

- *Significant learning experience* is presented when using online learning activities can enrich the learning experience of students.

  "terms of their experience of how they study is really important ... it enriches the learning experience ... and to be inspired *(From interviewee TC)"*

- *Supportive channels* is shown when tutors create online forums for students once a week and they has been watching the forums closely.

  "treat each student's responses respectfully and each student does the same thing in their online environment, ... an online forum, *(From interviewee TC)"*

Negative aspects for intrinsic improvement include insignificant accountability, limited experience, and nervousness of opinion.

- *Insignificant accountability* is shown when some students have laziness or reticence feeling for their accountability to interact with others.

  "Some it could be laziness, be reticence *(From interviewee TB)"*

- *Limited experience* is presented when tutor has limited experience and understanding.

  "own experiences are limited *(From interviewee TB)* limited understanding *(From interviewee TA)"*

- *Nervousness of opinion* is shown when online learning can break nervousness that a student can give an opinion different from other student's opinion.

  "different to another student's opinion *(From interviewee TC)"*

5.2.5 Thematic Code – Learning Administration

Learning administration is under the influence of any activity or environment for supporting students' learning including availability of supportive activities, and related technology or channel.

Positive aspects for learning administration include benefit of online learning / environment, tutor-supported activities, peer-supported activities, and supportive channels.

- *Benefit of online learning / environment* is shown when a safe online environment makes people feel comfortably to give their opinions together with students' interaction, online posting and reflective thinking.

  "if you create a safe online environment … where people feel safe to give their opinion,…it seems to be quite a supportive environment *(From interviewee TC)"*

- *Tutor-supported activities* are shown when tutors have different ways of material delivering for students. Tutor is encouraging students to interact with each other across their online space.

  "providing them with a different way of delivering material,encouraging students to interact with each other across their online space*(From interviewee TC)"*

- *Peer-supported activities* are shown when students are active and engaged by supporting each other. It's maintaining the respect for another person's knowledge together with passing of knowledge and thirsting of knowledge.

  "show that the students that are engaged more online actually do better **…** still maintaining the respect for another person's knowledge *(From interviewee TB)"*

- *Supportive channels* is explored when students are able to use online platform as an easy option and flexible way.

"students use that as an easy option, … and have some discussion … They do that both in the face to face and in virtual real tutes *(From interviewee A)"*

Negative aspects for learning administration include insignificant online learning, and inconsistent online interaction.

- *Insignificant online learning* is explored when some students spend more consuming time for working online.

  "actually it is more time consuming to work online … because they've done substandard online learning *(From interviewee TA)"*

- *Inconsistent online interaction* is explored when online interaction in a discussion board is very patchy and potentially very problematic.

  "if you are just purely talking about a discussion board, I think it's very patchy, … it's potentially very problematic *(From interviewee TA)"*

5.2.6 Thematic Code– Learning Mechanism

Learning mechanism is under the influence of any ability, activity, interaction and communication for supporting students' learning processes.

Positive aspects for learning mechanism include ability and activity for learning, and valuable communication / interaction.

- *Ability and activity for learning* is explored when key learning process for online is a creative, planning, and interactive process with participation. The learning processes and activities were centred on reading and responding in a written way. Students' practices will be successful, students have to be more proactive, more systematic and organised in their learning.

  "a learning process, … process in participating in that process the planning of creativity, … obviously using that interactive format *(From interviewee TB)"*

- *Valuable communication / interaction* is explored when students' learning can be very valuable if they communicate with each other. Valuable interaction includes an exchange of ideas and making an assumption.

"the learning can be very valuable, … and I expect that they use those things in their interactions with others … *(From interviewee TA)"*

Negative aspects for learning mechanism include insignificant interaction / feedback, and independent own learning.

- *Insignificant interaction / feedback* is explored when students were not able to succeed their online learning if they did not interact with each other.

  "if they don't interact, they can't be successful in this unit, … the least effective way of developing that is non interaction *(from interviewee TB)"*

- *Independent own learning* is explored when teaching team support students to know how to encourage themselves more independent in their own learning.

  "might be a situation where you can direct them on how to be more independent in their own learning *(from interviewee TC)"*

5.2.7 Thematic Code – Pedagogical Preparation

Pedagogical preparation is under the influence of content of assignments, assessment tasks, and unit introduction including objectives of learning and learning processes.

Positive aspects for pedagogical preparation include content for participation, assessment task, and unit introduction.

- *Content for participation* is explored when the content of all assignments and unit outline by teaching team supported students for making good sense of participation including the content of readings.

  "do a lot of in terms of the content that we use … so I scaffold them by first of all using the content of readings … *(from interviewee TA)"*

- *Assessment task* is explored when students were encouraged by teaching team to do assessment task successfully by due date of assessment time. Moreover, the purpose of assessment was shown how well students' group working was.

  *"*it's just really beautiful the work that they do ... Is the purpose, are we going to assess them on how well they work in a group *(from interviewee TB)"*

- *Unit introduction* is explored when students understood the objectives of learning and learning process in the unit by introduction.

  "an effective learning process … If the purpose of the assignment is to demonstrate this learning *(from interviewee TB)"*

Negative aspects for pedagogical preparation include insignificant task.

- *Insignificant task* is explored when there was an issue between individual assignments and group assignments.

  "and there can always be an issue between individual and group assignments *(from interviewee TB)"*

5.2.8 Thematic Code – Skills Development

Skills development is under the influence of the development of writing, reading and reflective thinking through online learning for further interactive communication understanding and interpretation.

Positive aspects for skills development include understanding reflective thinking skills, sense of online writing, reading awareness, interactive communication skills, and supportive channels.

- *Understanding reflective thinking skills* is explored when reflective thinking skills is important for supporting online practice and interaction with better doing assignment. If students do more thinking then they can develop their critical understanding.

  "the better reflective they will be, the better their assignment will be … terms of their thinking so that they bring in that critical aspect *(from interviewee TA)"*

- *Sense of online writing* is shown when students should be taught how to write appropriately online. The reliable writing skills influence the meaning delivery.

  "students need to be taught how to write appropriately online … sense of writing online is a different skill *(from interviewee TA)"*

- *Reading awareness* is presented when teacher often uses the reading as a vehicle for challenging students' own thinking and other students' critical thinking.

  "using the readings as a vehicle and get them to challenge their thinking *(from interviewee TA*)"

- *Interactive communication skills* is concerned that communication can be effective when both students and tutor are understanding with each other. When some students talk face-to-face with others, they all can get sorts of cues for their interpretation and communication.

  "communication can be very effective when both student and tutor are on the same page, if you understand what I mean, by that. *(from interviewee TA)"*

- *Supportive channels* is presented that tutor always expect students' writing in discussion board.

  "that covered the highlights or the particular points that students made on discussion boards, *(from interviewee TB)"*

Negative aspects for skills development include ineffective reflective thinking skills, and difficulty of writing in discussion board.

- *Ineffective reflective thinking skills* is explored that students' reflective thinking skills do not become effective if students do only reading.

  "it doesn't become effective at all for them if all they do is read about it *(from interviewee TA)"*

- *Difficulty of writing in discussion board* is presented that students are very frustrated with their inappropriate comment writing in discussion board.

  "I think quite often committing something to the discussion board in writing is quite difficult for them *(from interviewee TB)"*

5.2.9 Thematic Code – Student Experience

Student experience is under the influence of the preparation, engagement, and situation of students.

Positive aspects for student experience include available preparation, availability of engagement, and opinions presentation.

- *Available preparation* is concerned that students should prepare themselves at all times for their experience especially online.

  "and prepared at all times … you are part of the brain train so to speak when you are distanced from *(from interviewee TA)"*

- *Availability of engagement* is presented that although some students were stressed with their family, they like to have engagement with tutor support.

  "I think sometimes people view being engaged in a tutorial … and that's when they are able to engage so we have to offer that *(from interviewee TB)"*

- *Opinions presentation* is explored that some students have personal thinking from their point of veiws.

  "they can just learn about the content … they can be very personal … because often our views are very personal *from interviewee TB)*"

Negative aspects for student experience include unsatisfied assessment grades.

- *Unsatisfied assessment grades* is presented that students experienced emotional despair while they have received unsatisfied assessment grades.

  "Particularly, when they have received assessment grades that they not happy with *(from interviewee TA)"*

5.2.10 Thematic Code – Teaching Condition

Teaching condition is under the influence of teacher / tutor support together their accountability, teaching and learning activities, and expectation.

Positive aspects for teaching condition include accountability of teacher / tutor, challenging for online teaching and learning, and collaborative and supportive expectation.

- *Accountability of teacher / tutor* is presented that teacher and tutor take responsibility for giving students the recommendation according to the stress and problem. Tutors work together with any supports for students' online learning.

  "and I have called them at 9pm at night when they have been stressed about something or the other *(from interviewee TB)"*

- *Challenging for online teaching and learning* is shown that if students are taught explicitly about critical thinking, they will know values and experiences from online learning.

  "the fact that as human beings, we bring values and experiences to education … because this is my first experience of online learning *(from interviewee TC)"*

- *Collaborative and supportive expectation* is shown that tutors need students to do collaboration for engaging others in online environment.

  "we need to support people and all that sort of things happens *(from interviewee TB)*"

Negative aspects for teaching condition include disappointed technology and insignificant tutor support,.

- *Disappointed technology* is presented that tutors were frustrated with traditional discussion board.

  "the traditional we all use through MyLO ….. I was feeling very frustrated *(from interviewee TA)"*

- *Insignificant tutor support* is shown that tutors did not work successfully as a teacher because their students were failing and weren't engaging.

  "which meant that I did not feel successful as a teacher, because I had students who were failing, because they weren't engaging *(from interviewee A)"*

5.2.11 Thematic Code – Technology Affordances

Technology affordances are under the influence of the support and availability of technology according to students' learning and teaching team's using.

Positive aspects for technology affordances include availability of technology, technology with IT support team, online collaboration, and supportive channels.

- *Availability of technology* is shown that tutors have to realize how to use technology online. Also, they should put technology in the right place by the right way according to level of learning. Teaching team should make technology important, available, and easy for students to engage with proximity.

  "quite often technology is delivering all these new ways of doing things ... makes it easy for them to engage *(From interviewee TB)"*

- *Technology with IT support team* is shown that tutors are enabled by IT support team to learn about using technology with a sense of teaching. Also, IT support team is very important especially serving any purposes and fixing any problem.

  "IT support enabled me to learn a little bit about web conferencing …. and virtual rooms that gave me back a sense of teaching *(From interviewee TA)"*

- *Online collaboration* is explored that tutors use beneficial technology for supporting students' participation.

  "I think it's really beneficial to … because technology has improved *(From interviewee TC)"*

- *Supportive channels* is explore that tutors have various technology tools. Basic technology includes online discussion board for posting according to the tasks. Face-to-face virtual Collaborate is also available for students' learning.

  "they also their posts on the discussion board which are also interactive … well this year I am using Web conferencing *(From interviewee TA)"*

Negative aspects for technology affordances include insignificant technology and ineffective IT support.

- *Insignificant technology* is concerned that students sometimes would not like to use technology and some of them disagree with tutor on using technology.

"that creative process sometimes gets lost or taken away by the technology … but there would be others that disagree with me *(From interviewee TB)"*

- *Ineffective IT support* is explored that without having a good IT support system, online teaching and learning can be ineffective.

  "without having a good IT support system …. and in some cases ineffective *(From interviewee TA)"*

5.2.12 Thematic Code – Virtual Implementation

Virtual Implementation is under the influence of the interaction through face-to-face virtual tutorial according to the critical reflective thinking and appropriate technology tools.

Positive aspects for virtual implementation include face-to-face interactive online tutorial, thinking for virtual tutorial, and supportive channels.

- *Face-to-face interactive online tutorial* is shown that interactive online tutorial is great and fantastic for students' interaction, reflection and conversation.

  "it was fantastic … this is great … it's an evolutionary process… creating this interactive tutorial format where it can be face to face *(From interviewee B)* "

- *Thinking for virtual tutorial* is explored that the virtual tutorial really addresses on students' critical reflective thinking for sharing their ideas with each other.

  "I think the face-to-face online tute is something that really addresses that *(From interviewee TC)*"

- *Supportive channels* is presented that the virtual Collaborate tutorials are helpful for tutors to use discussion board more effectively in students' capacity.

  "web conference is conducted just the same as a face to face tutorial … supported by the discussion board *(From interviewee TA)*"

Negative aspects for virtual implementation include insignificant virtual tutorial.

- *Insignificant virtual tutorial* is presented that tutors are not able to access to virtual tutorial all the time and students are not able to be a massive contributor in virtual tutorial.

  "You might not be contributing. You may not be a massive contributor face-to-face, *(From interviewee TC)* "

5.3 Focus Group Data Analysis (FGDA) Stage One

This section will present the findings from the analysis of the focus group interviews. The interview analysis was conducted using Thematic Coding which is designed to identify the key themes that are presented the interview data. There are thirteen themes from FGDA stage one: community development, extrinsic improvement, facilitating thinking, intrinsic improvement, learning administration, learning mechanism, pedagogical preparation, skills development, student experience, teaching condition, technology affordances, virtual implementation and ***student demography***.

A deductive approach was taken with the thematic coding for the focus group data. The themes identified in IDA stage one were used as the basis for exploring the focus group data. New data set and one new theme emerged in FGDA stage one: ***student demography*** as can be seen in table 5.3. A table 5.3 with all the themes generated from the focus group data is provided in the Appendix J.

Table 5.3: New data set from FGDA stage one

Theme	Positive aspects	Negative aspects
Community Development	• *Discussion for communication*	• *Insignificant participation*
Extrinsic Improvement		• *Insignificant teacher support*
Facilitating thinking	• *Thinking for assignment*	• *Obstacle of thinking*
Intrinsic Improvement	• *Valuable reflection* • *Challenging by assignment*	• *Stressful aspects*
Skills Development	• *Questioning*	• *Difficulty for virtual communication*
Student Experience	• *Relevance for assumption* • *Learning from peers* • *Previous own experience*	• *Unfamiliar answering and asking question*
Teaching Condition	• *Clear expectation* • *Modes of communication*	
Student demography	• ***Background and employment***	• ***Unfamiliar online learning***

5.3.1 Thematic Code – Student Demography

Student demography is under the influence of background and employment.

Positive aspects for student demography include *background and employment.*

- *Background* is explored that students had different background including various age group, distinct family situation, and dissimilar interested study. Someone was mature aged student and was responsible for family care. They also had various purposes for their studying.

  "tell us about where they come from, how old they are, … They're adults, they have to go back to their family *(from interviewee A)"*

- *Employment* is explored that students worked in different areas, so they had different experiences and requirements for improving their career paths.

  "Some are already working in a school and in child care or something like that … why they're doing teaching *(from interviewee B)"*

Negative aspects for student demography include *unfamiliar online learning.*

- *Unfamiliar online learning* is explored that first year students just started their online learning and they were not familiar with online learning activities. They spent a period of time to be familiar with technology tools.

  "many of them just learning to use the technology of MyLO is a big thing …they can be introduced to other technologies *(from interviewee A)"*

5.4 Interview Data Analysis (IDA) Stage two

This section will present the results from the analysis of the semi-structured interviews. The interview analysis was conducted using "Thematic Coding" which is designed to identify the key themes that are presented the interview data. There are fifteen themes from IDA stage two: Community Development, Extrinsic Improvement, Facilitating Thinking, Intrinsic Improvement, Learning Administration**,** Learning Mechanism**,** Pedagogical Preparation, Skills Development**,** Student Demography, Student Experience, Teaching Condition, Technology Affordances, Virtual Implementation, ***Learning Environment***, and ***Orientation to Learning***.

A deductive approach was taken with the thematic coding for the interview data. The themes identified in IDA stage one and FGDA stage one were used as the basis for exploring the interview data in stage two. New data set and two new themes emerged in IDA stage two: ***Learning Environment*** and ***Orientation to Learning*** as can be seen in table 5.4. A table 5.4 with all the themes generated from the interview data is provided in the Appendix K.

Table 5.4: New data set from IDA stage two

Theme	Positive aspects	Negative aspects
Community Development	• *Supportive participation*	• *Insignificant reflection*
Extrinsic Improvement	• *Engagement awareness*	
Facilitating Thinking	• *Thinking demonstration and development* • *Activity for sharing of thinking*	• *Impact of personal thinking*
Intrinsic Improvement	• *Interactive discussion and engagement*	• *Insignificant creativity*
Learning Administration	• *Significant forum*	
Pedagogical Preparation	• *Opportunity for online learning*	• *Insignificant group working*
Student Demography	• *Education*	• *Not only studying* • *Isolation*
Learning Environment	• ***Environment for online learning***	-
Orientation to Learning	• ***Understanding the organization of unit*** • ***Supportive channel***	• ***Not complete understanding for online studying***

5.4.1 Thematic Code – Learning Environment

Learning environment refers to available environment for online studying. It is the exploration of the opportunities for interaction with each other.

Positive aspects for learning environment include environment for online studying.

- *Environment for online studying* is explored that students felt comfortable to study online in available environment. Also, they got the opportunities for interaction with each other through online.

  "I was okay with it because my whole degree's been online, … where they had the interaction with *(from interviewee A)"*

There are not any negative aspects for learning environment.

5.4.2 Thematic Code – Orientation to Learning

Orientation to Learning refers to understanding of the unit and related technology. It is the exploration of process of online learning.

Positive aspects for orientation to learning include understanding the organization of unit and supportive channel.

- *Understanding the organization of unit* is explored that it is very important for students to understand the organization of unit for further successful process of online learning.

  “because I was more organised at the beginning … and the processes of how to do an action plan *(from interviewee A)”*

- *Supportive channel* is explored that students were supported to study through the webinars every week.

  “they were really good because the webinars each week, *(from interviewee A)”*

Negative aspects for orientation to learning include not complete understanding for online studying.

- *Not complete understanding for online studying* is explored that some students generally did not understand about the process of online studying.

  “maybe because I didn’t quite understand that. *(from interviewee A)”*

5.5 Focus Group Data Analysis (FGDA) Stage two

This section will present the findings from the analysis of the focus group interviews. The interview analysis was conducted using Thematic Coding which is designed to identify the key themes that are presented the interview data. There are fourteen themes from FGDA stage two: Community Development, Extrinsic Improvement, Facilitating Thinking, Intrinsic Improvement, Learning Administration, Learning Environment, Learning Mechanism, Orientation to Learning, Pedagogical Preparation, Skills Development, Student Experience, Teaching Condition, Technology Affordances, and Virtual Implementation.

A deductive approach was taken with the thematic coding for the focus group data. The themes identified in IDA stage one, FGDA stage one and IDA stage two were used as the basis for exploring the focus group data. There is not new theme in FGDA stage two. Only new data set in FGDA stage two: can be seen in table 5.5. A table 5.5 with all the themes generated from the focus group data is provided in the Appendix L.

Table 5.5: New data set from FGDA stage two

Theme	Positive aspects	Negative aspects
Learning Environment	• *Environment for critical reflection*	• *Insignificant online learning*
Orientation to Learning	• *Understanding for online learning process*	• *Not understanding for online studying*

5.6 Interview Data Analysis (IDA) Stage three

This section will present the results from the analysis of the semi-structured interviews. The interview analysis was conducted using "Thematic Coding" which is designed to identify the key themes that are presented the interview data. There are nineteen themes from IDA stage three: Community Development, Extrinsic Improvement, Facilitating Thinking**,** Intrinsic Improvement, Learning Administration, Learning Environment, Learning Mechanism**,** Orientation to Learning, Pedagogical Preparation, Skills Development, Student Demography, Student Experience, Teaching Condition, Technology Affordances, Virtual Implementation, ***Content Engagement***, ***Human Relationship***, ***Moral Awareness***, and ***Time Management***.

A deductive approach was taken with the thematic coding for the interview data. The themes identified in IDA stage one, FGDA stage one, IDA stage two and FGDA stage two were used as the basis for exploring the interview data in stage three. New data set and four new themes emerged in IDA stage three: ***Content Engagement***, ***Human Relationship***, ***Moral Awareness***, and ***Time Management*** as can be seen in table 5.6. A table 5.6 with all the themes generated from the interview data is provided in the Appendix M.

Table 5.6: New data set from IDA stage three

Theme	Positive aspects	Negative aspects
Community Development	• *Significant interaction* • *Teacher support for communication* • *Moderator for Collaborate session* • *Collaborative group*	*Ineffective communication and interaction*
Extrinsic Improvement	• *Significant peer support* • *Supportive teaching team*	• *Insignificant feedback* • *Insignificant engagement*
Facilitating thinking	• *Way of thinking* • *Teacher support for thinking development* • *Peer support for thinking development*	• *Obstacle of thinking*
Intrinsic Improvement	• *Individual characteristics* • *Professional practice development*	• *Without understanding of practice*
Orientation to Learning	• *Introduction by teaching team* • *Tutorial sessions*	-
Skills Development	• *Reading and writing* • *Questioning for communication*	-
Student Experience	• *Opportunity of peer learning* • *The relevance of learning activities* • *Collaboration for learning experience* • *Visual online learning*	-
Teaching Condition	• *Role of teaching team* • *Working with students* • *Expectation for students' learning*	-
Technology Affordances	• *Asynchronous technology* • *Synchronous technology* • *Appropriate technology* • *Technology for peer learning* • *Teacher support for technology affordances*	• *Insignificant using technology*
Content Engagement	• ***Online participation*** • ***Understanding about content***	• ***No engagement with content***
Human Relationship	• ***Online relationship*** • ***Reflective thinking for relationship*** • ***Supportive channel***	-
Moral Awareness	• ***Peers agreement and disagreement*** • ***Comment for justification*** • ***Moral commitment for professional practices*** • ***Teacher support for moral awareness***	• ***Scare of judgement***

Theme	Positive aspects	Negative aspects
Time Management	• ***Balance of time*** • ***Time for peers interaction*** • ***Time for virtual Collaborate sessions*** • ***Time for discussion board***	• ***Insignificant reading time***

5.6.1 Thematic Code – Content Engagement

Content Engagement refers to encouraging students for online participation. It is the exploration of understanding about the content of unit.

Positive aspects for content engagement include online participation and understanding about content.

- *Online participation* is explored that students are encouraged by teaching team to participate confidently through online. Also, they were engaged in content of the unit as well.

  "… so that they are more confident in then engaging with the content. … *(from interviewee TA) ...*"

- *Understanding about content* is explored that students were encouraged to work with peers by understanding and engaging with the content of the unit.

  "… and what they are understanding from the content … Finding content, engaging with the content, … *(from interviewee TA) ...*"

Negative aspects for content engagement include no engagement with content.

- *No engagement with content* is explored that students felt accountable to interact with other students through online but some of them thought that it was not necessary to engage the content of the unit.

  "… Not necessarily engaging with the content, but participating in online interaction … *(from interviewee TA) ...*"

5.6.2 Thematic Code – Human Relationship

Human relationship refers to how to build online relationship with people. It is the exploration of online relationship and reflective thinking.

Positive aspects for human relationship include online relationship, reflective thinking for relationship, and supportive channel.

- *Online relationship* is explored that students were able to build relationship with each other through online with human being. Especially, they had human relationship with someone who have known before.

  "terms of building relationships with human beings … if you know who they are and you've got the relationship with … make online *(from interviewee TA)"*

- *Reflective thinking for relationship* is explored that students built online relationship by their thoughtful posts together with reflective thinking. They also developed their thinking when they made online relationship with each other.

  "respond with thoughtful posts then that's … to build a rapport, a relationship develops everybody's thinking at the same time *(from interviewee TA)"*

- *Supportive channel* is explored that virtual Collaborate session supported students for building human relationship by talking with each other. Also, their human relationship was essential for their online learning.

  "… It makes it so much easier to build real relationships because you're talking in real time and so, … talking with a real human being *(from interviewee TA)"*

There are not negative aspects for human relationship.

5.6.3 Thematic Code – Moral Awareness

Moral awareness refers to agreement and disagreement with justification for students' opinions or comments. It is the exploration of sharing ideas for professional practices.

Positive aspects for moral awareness include peers agreement and disagreement, comment for justification, moral commitment for professional practices, and teacher support for moral awareness.

- *Peers agreement and disagreement* is explored that when students interacted with each other, some students agreed with posted answer and some did not agree. Teaching team told students that the posted answers were not right or wrong.

Also, it seems that agreement is the praise to encourage students continued to interact with each other.

"not looking for a right or wrong answer … to think they have to agree with what I say*(from interviewee TF)* ... form of agreement … *(from interviewee TG)"*

- *Comment for justification* is explored that students explained with each other by giving their comments. Teaching team expected students gave their opinions by justification. Students sometimes gave comments without justification.

  "wanted to see that you could justify your opinion in this *(from interviewee TG)* only comment if they agree with each other *(from interviewee TF)"*

- *Moral commitment for professional practices* is explored that some readings encouraged students to have moral commitment for improving their profession.

  "And it said in the reading how teachers have a moral commitment to their profession *(from interviewee TF)"*

- *Teacher support for moral awareness* is explored that teaching team encouraged students to justify their thinking why some ideas were wrong. Moreover, students posted for assessment with moral justification.

  "and the justification of their thinking to justify why that's wrong *(from interviewee TF)* the posts that they make are assessed *(from interviewee TA)"*

Negative aspects for moral awareness include scare of judgement.

- *Scare of judgement* is explored that students were challenged about online judgement. When they shared their own ideas with each other, no one judged anyone. Some students thought about sort of things for biases because some ideas were related to their ideas accordingly.

  "big challenge in online … no one's judging anyone Students' worrying about judgement … they're worried about people judging it *(from interviewee TF)"*

5.6.4 Thematic Code – Time Management

Time management refers to balancing time for working learning activities through online. It is the exploration of working in virtual Collaborate sessions and working in discussion board.

Positive aspects for time management include balance of time, time for peer interaction, time for virtual Collaborate sessions, and time for discussion board.

- *Balance of time* is explored that students worked out how to organize time for working learning activities and critical thinking with encouraging by teaching team.

  "trying to work out how to organise time *(from interviewee TF)* having done it now for four years, …see all the things *(from interviewee TG)"*

- *Time for peer interaction* is explored that students who had good relationship with each other spent more time for peer interaction with deep reflection by reading others' post, getting feedback from peers, and responding with strong argument. Moreover, teaching team supported students for reassuring communication time and practising time.

  "for a small period each day *(from interviewee TA)* strength of the argument that some other student or someone's put there *(from interviewee TG)"*

- *Time for virtual Collaborate sessions* is explored that students planned their available time for virtual Collaborate session by accessing and typing their ideas through online. They also thought that virtual Collaborate session was effective for communication with each other.

  "Collaborate sessions currently, … *(from interviewee TA)* can see that that could be quite effective, … one of those a week *(from interviewee TG)"*

- *Time for discussion board* is explored that students interacted with each other through discussion board at their posting time according to the way of threading. Some students had willingness to spend more time-consuming for communication and interaction with each other.

"… So a minimum probably of three times *(from interviewee TA)* ... so it's much more time-consuming to do it that wa*y (from interviewee TG)"*

Negative aspects for time management include insignificant reading time.

- *Insignificant reading time* is explored that students started their communication by reading others' post although they did not often have time for reading.

  "… or don't often have the time to read every other student's response, and they don't *(from interviewee TG)"*

5.7 Focus Group Data Analysis (FGDA) Stage three

This section will present the findings from the analysis of the focus group interviews. The interview analysis was conducted using Thematic Coding which is designed to identify the key themes that are presented the interview data. There are twenty two themes from FGDA stage three: Community Development, Content Engagement, Extrinsic Improvement, Facilitating Thinking, Human Relationship, Intrinsic Improvement, Learning Administration, Learning Environment, Learning Mechanism, Moral Awareness, Orientation to Learning, Pedagogical Preparation, Skills Development**,** Student Demography, Student Experience, Teaching Condition, Technology Affordances, Time Management, Virtual Implementation, ***Assessment Driven***, ***Conversations, and Technology Integration***.

A deductive approach was taken with the thematic coding for the focus group data. The themes identified in IDA stage one, FGDA stage one, IDA stage two, FGDA stage two, and IDA stage three were used as the basis for exploring the focus group data. New data set and three new themes emerged in FGDA stage three: ***Assessment Driven***, ***Conversations, and Technology Integration*** as can be seen in table 5.7. A table 5.7 with all the themes generated from the focus group data is provided in the Appendix N.

Table 5.7: New data set from FGDA stage three

Theme	Positive aspects	Negative aspects
Intrinsic Improvement	• *Encouragement for participation*	-
Orientation to Learning	• *Significant instruction*	-
Skill Development	• *Reading and writing*	-
Student Experience	• *Group of students*	-
Assessment Driven	• ***Assessment task*** • ***Peer interaction*** • ***Posting*** • ***Verbal communication***	• ***Responding by assignments***
Conversations	• ***Meaningful conversation*** • ***Being moderator*** • ***Engagement for conversation***	• ***Unnatural conversation*** • ***Difficulty for conversation***
Technology Integration	• ***Notification of discussion board*** • ***Technology-supported peer learning***	-

5.7.1 Thematic Code – Assessment Driven

Assessment Driven refers to the importance of assessment according to students' participation in online environment. It is the exploration of peer interaction based on assessment task and assignment involving posting and verbal communication.

Positive aspects for assessment driven include assessment task, peer interaction, posting, and verbal communication.

- *Assessment task* is explored that online participation is compulsory for students who would like to complete their assessment task. Especially, students are able to communicate with each other for producing their final assessment task.

  "Early on in the unit, participation online was part of their assessment they needed to do it … producing your final assessment task *(from interviewee A*)"

- *Peer interaction* is determined that students will interact with each other, if assessment task defines that students' interaction is one of their learning activities.

"interactions is what we were basing that first assessment task people interacted *(from interviewee A*) clarification of assessment tasks *(from interviewee B)*"

- *Posting* is explored that after students access online, students are able to participate with each other by posting according to their assessment.

  "… and use their posting as part of their assessment *(from interviewee A)* …"

- *Verbal communication* are supported students for understanding the benefit that they will get when they are asked for communication according to their assessment task.

  "… and verbalise your understanding of it in that assessment task *(from interviewee A)* …"

Negative aspects for assessment driven include responding by assignments.

- *No responding by assignment* is explored that students' participation is influenced by their unit assignments. If students have a lot of their unit assignments, they will not response immediately for assessment task.

  "… or they were doing their assignments *(from interviewee B)* …"

5.7.2 Thematic Code – Conversations

Conversations refer to peers conversation through online, face-to-face conversation, and being moderator. It is the exploration of the meaningful conversation and engaging conversation.

Positive aspects for conversations include meaningful conversation, being moderator, engagement for conversation, and supportive channels.

- *Meaningful conversation* is presented that students were able to have well conversation through online. Better conversation should be happened by same place without interrupting anyone's talking. Moreover, peers conversation was good when students shared their different experiences with each other.

  "good conversations*(from interviewee B)* meaningful conversation versus being online *(from interviewee A)* well about different things *(from interviewee C)*"

- *Being moderator* is presented that students were frustrated when they were unable to be a moderator. However, teacher always supported them by modelling herself how to do.

  "weren't a moderator *(from interviewee A)* I found that really memorable, to kind of use to model myself on I suppose *(from interviewee C)*"

- *Engagement for conversation* is explored that peers interaction was occurred by engaging their conversation. The lengthy conversations also influenced the conversation between students, and student with teaching team.

  "and certainly some engaging conversations lengthy conversations between myself and those people and the tutor *(from interviewee B)*"

- *Supportive channel* is presented that advanced technology for quick conversation in virtual Collaborate sessions supported students' engagement with peers and content together with well face-to-face peers conversation.

  "allows for that dialogue amongst peers … face-to-face… technology needs Collaborate sessions happen so quickly *(from interviewee A)*"

Negative aspects for conversations include unnatural conversation and difficulty for conversation.

- *Unnatural conversation* is explored that students have to wait for responding because their conversation in virtual Collaborate session flew unnaturally.

  "have to wait for a response, which isn't at all natural conversation, it didn't flow naturally *(from interviewee A)*"

- *Difficulty for conversation* is presented that difficulty of active conversation or instant face-to-face conversation in virtual Collaborate sessions can be occurred for more than two involved people.

  "… think the Collaborate sessions were very difficult if you had more than *(from interviewee A)* instant connection … have face-to-face *(from interviewee B)*"

5.7.3 Thematic Code – Technology Integration

Technology integration refers to setting notification for supporting peer learning. It is the exploration of discussion board, and email.

Positive aspects for technology integration include notification of discussion board, and technology-supported peer learning.

- *Notification of discussion board* is presented that students should set up notifications of discussion board for supporting peer interaction. These notifications were forwarded to their email. Then, they were reminded to response others comments for further continuing peer learning together.

  "discussion groups … direct feed to their personal email *(from interviewee A)* notification occasionally …go back through and read *(from interviewee B)*"

- *Technology-supported peer learning* is explored that technology integration significantly supported peer learning by encouraging students more interaction. Not only university technologies but also another familiar technologies were integrated to help students more comfortable learning together in online environment.

  "maybe if there was some way we could integrate that into university that would help people interact a bit more … as in peer-to-peer *(from interviewee C)*"

There are not any negative aspects for technology integration.

5.8 Comparison of the themes from three stages of qualitative data analysis

This section provides an analysis of interviews and focus groups undertaken in three stages. From stage one of initial stage and stage two of complementary stage, there are totally 15 themes including community development, extrinsic improvement, facilitating thinking, intrinsic improvement, learning administration, learning environment, learning mechanism, orientation to learning, pedagogical preparation, skills development, student demography, student experience, teaching condition, technology affordances, and virtual implementation.

At stage one, teaching team and students agreed together that teaching team are able to support students' learning but teaching team did not know how to use technology to encourage students for working together. Also, students were worry for online studying because of their different demography.

At stage two, teaching team tried to use more than one technology for supporting students' online learning. Moreover, they realized how to set up available learning environment according to student's availability and demography as well.

At stage three with launching redesigned unit, orientation to learning was one of important element for students who studied peer learning in online environment. Students have to understand teaching team's expectation and the importance of technology-supported peer learning activities.

Finally there were seven new themes at the end of stage three including assessment driven, content engagement, conversations, human relationship, moral awareness, technology integration, and time management. These themes show that when students feel comfortable with their peers, they are accountable and work effectively and cooperatively with their groups on assessement tasks. Moreover, technology-supported affordances and integration including synchronous and asynchronous technologies should be considered for peer learning in online environment.

5.9 Chapter summary

This chapter presented the outcome of the qualitative data analysis of the data collected by interview with teaching team and focus group with students. From stage one and stage two, there are totally 15 themes including community development, extrinsic improvement, facilitating thinking, intrinsic improvement, learning administration, learning environment, learning mechanism, orientation to learning, pedagogical preparation, skills development, student demography, student experience, teaching condition, technology affordances, and virtual implementation. In addtion, there are new seven themes at the end of stage three including assessment driven, content engagement, conversations, human relationship, moral awareness, technology integration, and time management. Finally, there are totally 22 themes in the theme list. (see Appendix O)

Chapter 6: Interpretation and Discussion

6.1 Introduction

This chapter covers the interpretation and discussion of the quantitative data analysis and results in chapter 4 and the qualitative data analysis and results in chapter 5. This section presents the researcher's interpretation of the results and discusses them in relation to the existing body of literature. There are three parts: student related factors, organization and delivery for online peer learning, and the student learning experience.

This chapter is divided into the following sections:

- Section 6.2 provides a summary of data analysis from chapter 4 (quantitative data analysis and results) and chapter 5 (qualitative data analysis and results).
- Section 6.3 describes student related factors in order of their significance.
- Section 6.4 describes the organization and delivery for online peer learning, including peer learning attributes, the teaching team, and technology.
- Section 6.5 describes seven learning experiences of students, focusing on student related factors as well as the organization and delivery for online peer learning.
- Section 6.6 provides a summary of this chapter.

6.2 Summary of Data Analysis

The quantitative data analysis and results in chapter 4 and the qualitative data analysis and results in chapter 5 showed that there are a lot of differences and an overall complex relationship between student related factors, organization and delivery for online peer learning, and the student learning experience (see figure 6.1).

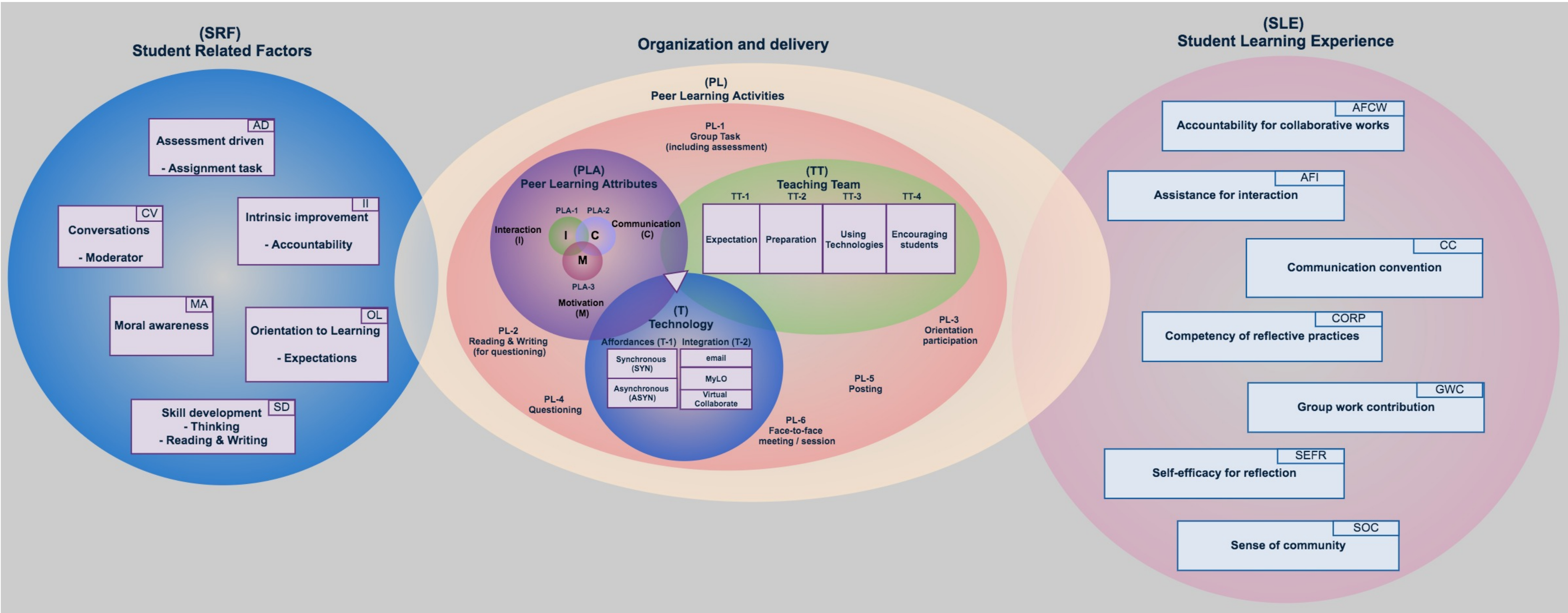


Figure 6.1: Summary of data analysis

Let's take a closer look at figure 6.1:

Firstly, student related factors (SRF) regards what is happening to the students themselves, taking into account self-responsibility or the fact that the student is not forced to study by anyone else. Moreover, each person determines whether he/she wants to do it or not (Zhao et al. 2011). The student's own thoughts determine whether to engage in conversation or develop his/her own skills according to the student's own level of willingness to participate in the learning process (Imlawi 2013), in light of the learning experience that he/she has had to-date (Eom, Wen & Ashill 2006). By interacting with each other through social networks and group work (see the details in chapter 4), it is found that each learner must take responsibility for his/her own duties. This is a stimulus from the inside, one that is intrinsic (Pass & Neu 2014). Consequently, the learner can become enthusiastic in working with others, for instance by having a conversation or otherwise giving feedback and comments.

SRF consist of assessment driven, conversations, intrinsic improvement, moral awareness, orientation to learning, and skill development. Although these factors are mainly taken from the theme list in chapter 5 (qualitative data analysis and results), two factors are included from the factor analysis in chapter 4 (quantitative data analysis and results): skill development, especially thinking, reading and writing, and intrinsic improvement, especially accountability. After attending orientation, students understand what teachers expect from students. Then students are assigned to work on assignment tasks together, on which they will be assessed. Everyone must be responsible for his/her own function. Obviously, everyone has different skills. Developing skills for critical thinking is necessary before reading the comments of others and writing back to them. Also, they should have moral awareness by understanding of the different students. Everyone should engage, and a student can lead the conversation as moderator.

Secondly, organization and delivery consists of peer learning activities in relation to peer learning attributes, thenteaching team, and technology. The list of peer learning activities is drawn from chapters 4 and 5. Only orientation participation and face-to-face meeting come from theme list in chapter 5. For peer learning attributes, we met interaction, communication and motivation in both chapter 4 (social network diagram and factor analysis) and chapter 5 (theme list). For the teaching team, the expectation and preparation come from the theme list in chapter 5 while using technologies and encouraging students appear in both chapter 4 (descriptive spreadsheet, factor analysis) and chapter 5. For technology, the list of synchronous and asynchronous technologies is from the theme list in chapter 5. During events in the course, some activities are individual work when students do not have to rely on others, for example, orientation participation or reading and writing for questioning. Other activities, including face-to-face meeting, posting, and group tasks, require students to work together. Moreover, information, communication, and motivation influence each other. Frequency of interaction is not significant, but the perception of content quality exchanged is significant and depends on motivation.

Lastly, the student learning experience (SLE) is based on the students' responsibility to work with others, which entails effective communication for supporting each other. Thus, everyone has to share the learning experience for group work to take place (Limbu & Markauskaite 2015). The SLE begins with the student's self-motivation. Then there is the learning experience that requires interaction or conversation through collaboration (Jia, Hiltz & Bieber 2008), as a contribution to group work and the sense of community (Hsu & Hsieh 2011). These follow the assignment tasks and limit time as self-efficacy for reflection.

SLE consists of accountability for collaborative work, assistance for interaction, communication conventions, competency of reflective practices, group work contribution, self-efficacy for reflection, and sense of community. These come from the theme list in chapter 5, and both communication conventions and competency of reflective practices are brought from chapter 4 (factor analysis) and chapter 5 (theme list). Learning experience, especially from group work can differ greatly. This could have an impact on the support of the interaction and communication between students. It can be said that if students are able to make reflective comments, group work will be facilitated accordingly. Also, effectiveness of self-efficacy and sense of community support the improvement of the student learning experience.

Students have different learning experiences based on not only on the students themselves, but also on the influence of peer learning activities with supporting of the teaching team and technology. However, students communicate and interact together with motivation from each other.

In this chapter, an interpretation is presented the most significant set of interrelationships among the factors that were identified in the data analysis. Student related factors, organization and delivery for online peer learning, and student learning experience are presented respectively as follows.

6.3 Student related factors

Over two years of data collection and analysis with the teaching team and students to find out what affects the development of online peer learning, the redesigned units from the feedback of previous two stages were launched in stage three. From the theme list of qualitative data analysis (see Appendix O), this figure confirms that assessment driven, conversations, intrinsic improvement, moral awareness, orientation to learning, and skill development are six student related factors (see figure 6.2).

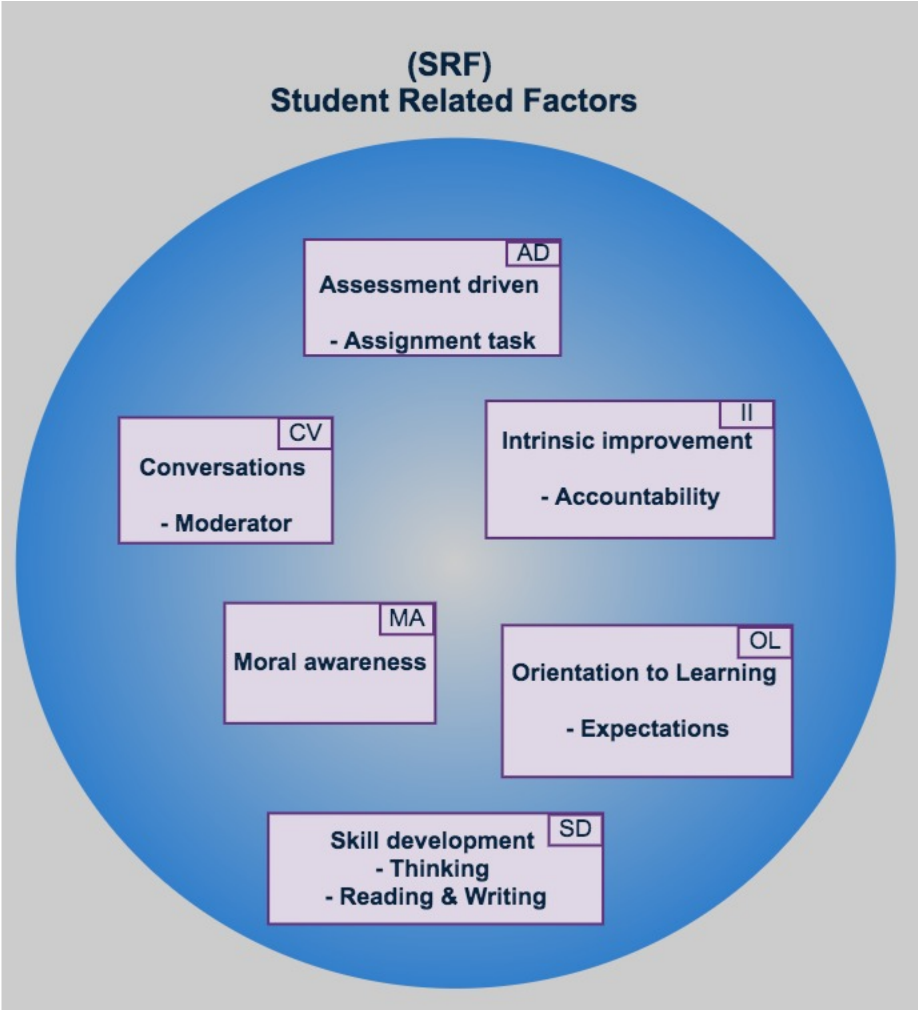


Figure 6.2: Student related factors (SRF)

6.3.1 Intrinsic improvement

Considering intrinsic improvement in learners' self-learning and learner-centered studying, students or learners are able to interact through online learning by their own studying and resources (Webster 2008). From interviews with the teaching team and the focus group with students in chapter 5, both the teaching team and students agreed that critical reflection, engagement improvement, and individual characteristics influenced students' intrinsic improvement. For the students themselves, although each person had an individual lifestyle, their understanding was created by their own ideas and peers' ideas based on mutual interests. This reduced anxiety and encouraged them to participate in collaboration. Teaching teams used technology for motivating peers and developing students' professional practices for further intrinsic improvement accordingly. Moreover, the teaching team should inform students how to reflect, how to work with engagement and participation, and what the importance of professional practices is. However, learner behaviors should be considered according to available courses; cognitive human learning may work according to learner information transformation (Clark & Mayer 2008). From chapter 5 qualitative data analysis and results in all stages, it is significant that intrinsic improvement required students' individual reflection and professional practices with their own understanding for peer engagement and participation during peer learning activities especially posting and communication with each other.

6.3.2 Orientation to learning

Student learning can be improved by encouraging students to understand the needs or expectations of teachers through orientation to learning (see the theme list of qualitative data analysis (in Appendix O) in stages two and three). By giving suggestions or advice earlier, especially at the beginning of course, students are able to understand and appreciate the importance of working together and comprehending what they have to do in their learning activities, including posting on the discussion board. Conducting instruction, promoting connections, and observation were aspects of online facilitation (Ng, Cheung & Hew 2012). Also, instruction and consultation from teachers still were important for peer learning (Topping & Ehly 2001). However, teachers and students had different view about the orientation to learning. Students focused on how to do learning activities with critical reflection for their professional practice, the particular relevance of each module, the understanding of course content with expectation of peer interaction, and reading for sharing their own ideas. On the other hand, the teaching team considered the preparation of the tutorial sessions to be important for student learning. Also, they encouraged students to start posting and introduce themselves to other students on personal intent. Chapter 5 qualitative data analysis and results in stages two and three showed that orientation to learning included the understanding of the importance of orientation, instruction, reflection, relevance, communication, and reading together with unit introductions and personal introductions. Students need to be informed about the teaching team's expectations and student learning activities, together with their professional practice and introductory activities with their own posting at the beginning of the semester.

6.3.3 Skill development

For learning activities, reading and writing skills are important. Both these skills have a direct impact on the development of ideas and communication. Also, questioning is one of learning activities that influenced effective communication with valuable comments. Managing questioning is helpful for students' interactive communication (Choi, Land & Turgeon 2005). Communication between peers and the teaching team are supported by questioning (Hatzipanagos & Warburton 2009). Significantly, both the teaching team and students agreed that reading and writing skills are important for students to communicate with peers and to develop their critical thinking online (see the theme list of qualitative data analysis (in Appendix O) in all stages, focusing on the theme 'Skills Development'). In addition, the teaching team considered that questioning was relevant to student communication, based on mutual interests. Oral communication was important for student communication in virtual Collaborate sessions. Also, skill development, especially the skills of reading and writing, are influenced by student communication and learning activities. However, development of thinking skills and continuity of communication are considerable on questioning based on reading and writing skills.

6.3.4 Assessment driven

Assessments of student activities are assigned by the teaching team (Yu 2011). They cover the activities of the students to interact with each other, for example, posting messages on the discussion board and communicating verbally in the virtual tutorial session. Assessment is involved in collaborative discussion and small group collaboration online (Swan, Shen & Hiltz 2006). Significantly, it is a critical part of the learning experience to improve the quality of learner studying and of teaching (Keppell et al. 2006). In the view of the students, what they concerned the availability of learning including assessment tasks that needed to be evaluated together, interaction between the students, posting messages to exchange ideas with each other, and verbal communication. If students wanted to complete an assessment task, they had to interact with each other, post and request communication according to their assessment. However, students may not respond immediately to each other because of a lot of their assignments (see the theme list of qualitative data analysis (in Appendix O) in stage three focusing on the theme 'Assessment Driven' from the focus group of students). Moreover, assessment driven focused into the importance of assessment according to student interaction in the online environment. It also explored peer interaction based on assessment tasks and assignments involving posting and verbal communication.

6.3.5 Conversations

Conversation between the students requires a moderator, who is essential to start and maintain the continuity of conversation. Conversations and collaboration have a relationship to learning. Information is also acquired through conversations. Moreover, students learn by using conversation with description and action (Naismith et al. 2004). In the opinion of the students, they have meaningful conversations through virtual Collaborate sessions with different experiences. It seems that the lengthy conversations influenced student conversations. Although the teaching team always supported students to moderate, students were frustrated with not being chosen as moderator (see the theme list of qualitative data analysis (in Appendix O) in stage three focusing on the theme 'Conversations' from focus group of students). In addition, conversations included online with peers, face-to-face conversations, and being the moderator. After launching the redesigned unit in stage three, it is significant that students needed meaningful conversations and they wanted to be engaged in conversation.

6.3.6 Moral awareness

A considerable moral awareness was appropriate when students responded to each other during peer learning activities. Considering moral awareness as part of feedback or comments for the online community, feedback influenced the relationship and interaction between members of the community for further processing of their learning (Boling et al. 2012). It is significant that teachers and students had different view about moral awareness. Students focused on the concept of idea alignment and criticism by others. They were able to apply other students' ideas to their own ideas. Other students' ideas were not continued obstacles. On the other hand, the teaching team considered most important support for peers' agreement and disagreement with posted answers, student comments with justification, and the moral commitment for improving students' professional practices. Students have to justify why some ideas were wrong but no one judged anyone and biases should be ignored (see the theme list of qualitative data analysis (in Appendix O) in stage three, focusing on the theme 'Moral Awareness' from interviews with the teaching team and focus group of students). In addition, moral awareness refers to thinking and sharing ideas amongst students together with agreement and disagreement with justification for the opinions and comments of other. However, students realized the importance of their own judgment for sharing ideas and giving feedback to each other for further enhancing their professional practice.

Individual students have to take action and control everything themselves. Also, their learning experience can be improved based on their responsibilities and learning progress. On the other hand; assessment driven, conversations, and moral awareness did not influence individual students directly; rather they influenced group interacting with each other through work assignments and discussions. Also, students who interact with other students or the teaching team concerns with assessment driven, conversations, and moral awareness. Moreover, they related the decision of agreement or disagreement to personal opinion or experience.

Student related factors (SRF) connote what is happening to the students themselves, as well as self-responsibility that is not forced on them by anyone else. Moreover, each individual determines whether he/she wants to participate or not, in accordance with his/her own thoughts on engaging in conversation or developing skills according to his/her own level of willingness to take part in the learning process. (Falkner & Falkner 2012). Personality is accordingly very important in maximizing one's own learning experience (Keller & Karau 2013). Significantly, if any person does not want to learn, it lacks the necessary skills in thinking, writing and reading, or is absent from the orientation, he or she will likely be unsuccessful in studying and have an ineffective learning experience (Tsai & Tsai 2014). Students are not able to complete the assigned task, they do not have conversations, or they do not respect each other because of other, more insignificant factors (Vonderwell & Zachariah 2005).

After analyzing quantitative data (chapter 4) and qualitative data (chapter 5), it is clear that what influences the student's improvement of learning experience is the responsibility of the student with attending the essential orientation. The importance of thinking skill, reading skill and writing skill is also considered to be very significant levels. The fact that without individual students' encouragement by intrinsic improvement, orientation to learning, and skill development then working with their peers can not proceed accordingly.

6.4 Organization and delivery for online peer learning

After using redesigned unit, organization and delivery for online peer learning considered peer learning activities together with peer learning attributes, teaching team, and technology. Peer learning activities consisted of face-to-face meetings/sessions, group tasks (including assessment), orientation participation, posting, questioning, and reading & writing (for questioning). Doing peer learning activities was related to peer learning attributes, with the support of the teaching team and technology. The organization and delivery for online peer learning is shown in figure 6.3

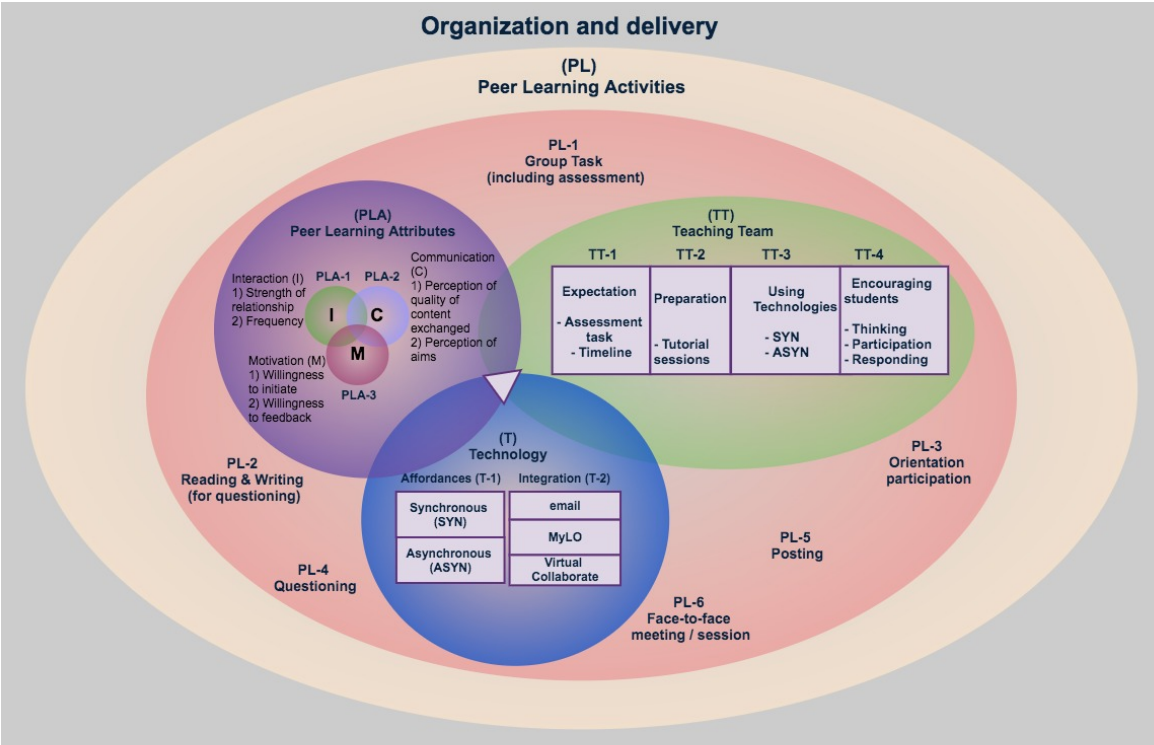


Figure 6.3: Organization and delivery for online peer learning

Peer learning attributes include interaction, communication, and motivation. Teaching team duties consist of setting expectation, study preparation, using technologies, and encouraging students. Also, technology includes both affordances and integration.

6.4.1 Peer learning attributes

Peer learning attributes included interaction, communication, and motivation. Interaction is closely connected with communication, which in term closely relates to motivation. Interaction and communication support each other in student learning. At the same time, communication and motivation encourage student to learn together.

Interaction

Interaction is reciprocal action to create a powerful community by exchanging learning experiences with each other through peer learning activities (Abrami et al. 2011). It is a process where participants affect or change each other in accordance with mutual interest (Fink 2007). Also, it can create both positive and negative relationships based on the results of interaction between participants (Wanstreet 2006). From the chapter 4 quantitative data analysis and results, the results from not only social network analysis but also factor data analysis show that the dynamic of interaction depended on mutual collaboration. At the beginning of the semester, after the students received the assignments and learning activities from the teaching team, students had to finish their tasks on schedule. It is found that the improved learning method in the redesigned units with an orientation to learning helped students understand the requirements of related learning activities. In particular, the groups needed to work together, raising any if something feedback and discussion with each other. According to the factor analysis in the chapter 4 quantitative data analysis and results, students initiated personal participation with peer interaction at the beginning of the semester. Student interaction was also influenced by asking, responding, and sharing their own ideas, as well as praising each other (see figure 4.29). From the results of the descriptive spreadsheet analysis in stage three of using the redesigned units, students were significantly encouraged to interact with each other with the support of the teaching team and the course technology used.

Communication

Communication often has the experience or information to pass with each other through peer learning activities. This is to develop students' learning together (Revere & Kovach 2011; Xiaofei, Saddik & Georganas 2003). It is also a technique that creates mutual understanding and increases the efficiency of ideas (Yoany 2006). Moreover, forward thinking requires communication through reading and writing. From the chapter 5 qualitative data analysis and results, the results from all stages show that communication is important for student exchange of ideas during interaction. Student interaction with regard to communication influences the messages and interactive experiences that can lead to a significant gain in learning together. According to the factor analysis in the chapter 4 quantitative data analysis and results, communication and peer engagement influenced each other. Students understood how they learn to share ideas with their peers in order to further their meaningful contribution (see figure 4.36) while the teacher modelled good practices for supporting student communication (see figure 4.30 and figure 4.29) and encouragement of peers (see figure 4.34). Moreover, student communication and peer engagement influenced each other (see figure 4.33 and figure 4.31). It was possible that peer encouragement also led to student communication (see figure 4.30). Significantly, students' ability to think critically depended on good communication (see figure 4.30 and figure 4.31).

Motivation

Motivation causes a person to act in a certain way when communicating through peer learning activities (Eisenkopf 2010). It stimulates the desire to be continually interested in accomplishing the learning objectives (Duff & Quinn 2006). From the chapter 5 qualitative data analysis and results, the results from all stages show that students need motivation by their self reflection to help them studying online together. When students want to communicate and exchange ideas with each other, it is based on their self reflection and mutual motivation. The ease of student communication under motivation leads to positive interaction. It also does not augment the anxiety that may result from students' own weaknesses, such as educational background or demography problem. According to the factor analysis in the chapter 4 quantitative data analysis and results, peer encouragement was considered as important for motivation. It influenced students' critical thinking (see figures 4.29, 4.32 and 4.37) and it significantly influenced students to become accountable to themselves in communication with their peers (see figure 4.34). Technology was used for supporting peer encouragement with further communication as well (see figure 4.30).

Interaction is determined by the strength of the relationship and desired frequency. However, both student interaction and communication intersect. Frequency of interaction does not necessarily result in improvement of the student learning experience. Perception of quality of content exchanged and perception of aims from communication must be considered along with interaction. Moreover, willingness to initiate and willingness to give feedback from motivation influenced communication as well.

6.4.2 Teaching team

Teachers have a responsibility to support students' online learning with all the ways to facilitate learning and to develop mutual learning (Vaughan 2007). In addition, they also prepare the learning environment and tools, including the appropriate technologies. Teachers must understand the potential of different students and encourage them to study and support each other (Zakaria 2013). The chapter 5 qualitative data analysis and results show that the teaching team has at least four important responsibilities: 1) expectation with assessment task and timeline; 2) preparation of tutorial sessions; 3) using technologies with synchronous and asynchronous features; 4) encouraging students to think, participate and respond. The teaching team took responsibility for supporting and challenging online teaching and learning. A significant teacher or teaching team is a factor in extrinsic improvement of student engagement awareness and valuable thinking. Although some teaching teams had difficulty with online teaching or using new technology, they encouraged students to do the assessment task by learning activities, for example, by posting messages on the discussion board, sending email, and taking part in face-to-face virtual tutorial sessions. The teaching team also committed on pedagogical preparation including course introduction, assignments and assessment tasks for encouragement and compulsory participation. However, the learning administration (for supporting learning activities) and the learning environment (as an online space) are also provided for the students' comfort in learning. According to the factor analysis in the chapter 4 quantitative data analysis and results, the teaching team took responsibility to be the moderator and engage students for participation in peer engagement (see figures 4.32 and 4.36). They modelled good practices for peer engagement (see figure 4.32) and enhancing students' professional practices (see figures 4.31, 4.33 and 4.37). The teaching team was able to support student communication (see figures 4.29, 4.30 and 4.34). Moreover, students were supported by the teaching team's modelling for critical thinking as well (see figure 4.35).

Teachers support students to be comfortable with learning by helping them understand the expectations, carry out preparation, use appropriate technology, as well as participate with each other.

6.4.3 Technology

Technology is an important tool for developing online peer learning by students. Teachers can use technology to promote and support student learning. Also, students can learn at any place and at any time according to their convenience (Vonderwell, Liang & Alderman 2007; Williams & Sawyer 2015). In the chapter 5 qualitative data analysis and results, it is shown that technology is used in two parts: technology affordances and technology integration. Technology can afford and support students' learning by synchronous features (for example, using virtual Collaborate sessions) or asynchronous features (for example, using email and the MyLO university learning management system, depending on the purposes of learning and the availability of students. Technology can be integrated for improving the learning experience by combining the capabilities of email, the learning management system (MyLO), and virtual Collaborate sessions together. Certainly, the available technologies needed effective IT support to make student engagement in interactive online learning activities coincide with their willingness to use the technology. According to the factor analysis in the chapter 4 quantitative data analysis and results, supportive technology is used for helping students use critical thinking for interaction and for sharing their own ideas with peers (see figure 4.37). Also, technology is used for enhancing students' professional practices based on their understanding of what they are interested in doing (see figure 4.36). Not only the teaching team used technology for modelling good practices (see figures 4.35 and 4.31), but also students used technology to deepen critical thinking (see figure 4.33), to become accountable themselves for their peers (see figure 4.34) and to influence peer encouragement (see figure 4.30). In addition, students used technology and critical thinking to engage their interaction (see figure 4.32).

These of appropriate technology will bring the greatest benefit to students. For instance, students are able to contact the teacher by email. They also communicate with the teacher or other students immediately by synchronous technology through virtual Collaborate sessions. Moreover, they can post any interesting questions or messages by asynchronous technology through discussion board of university learning management system.

6.5 Student Learning Experience

The student learning experience (SLE) is based on the students' responsibility to work with others, which entails effective communication and competency in supporting each other Thus, everyone has to share the learning experience for group work to take place (Claros, Cobos & Collazos 2016). SLE is directly influenced by the individual student who takes responsibility for collaborative work, has the potential to work effectively, and is self reflective. Moreover, students support each other by interaction, communication, group contribution, and community as a result of student related factors (SRF) (Hébert & Hauf 2015).

After using the redesigned units, students gained seven important learning experiences: accountability for collaborative works, assistance for interaction, communication convention, competency of reflective practices, group work contribution, self-efficacy for reflection, and sense of community. The student learning experience is shown in figure 6.4

To create the diagram of student learning experience (SLE) by discussion about the factors that affect students, first of all individual students who have self-learning are considered. It is important to have a clear distinction between six student related factors influencing seven student's learning experience. Intrinsic improvement, orientation to learning, and skill development have a direct influence on accountability for collaborative works, competency of reflective practices, and self-efficacy for reflection accordingly. On the other hand assessment driven, conversations and moral awareness have a direct influence on assistance for interaction, communication convention, group work contribution, and sense of community accordingly.

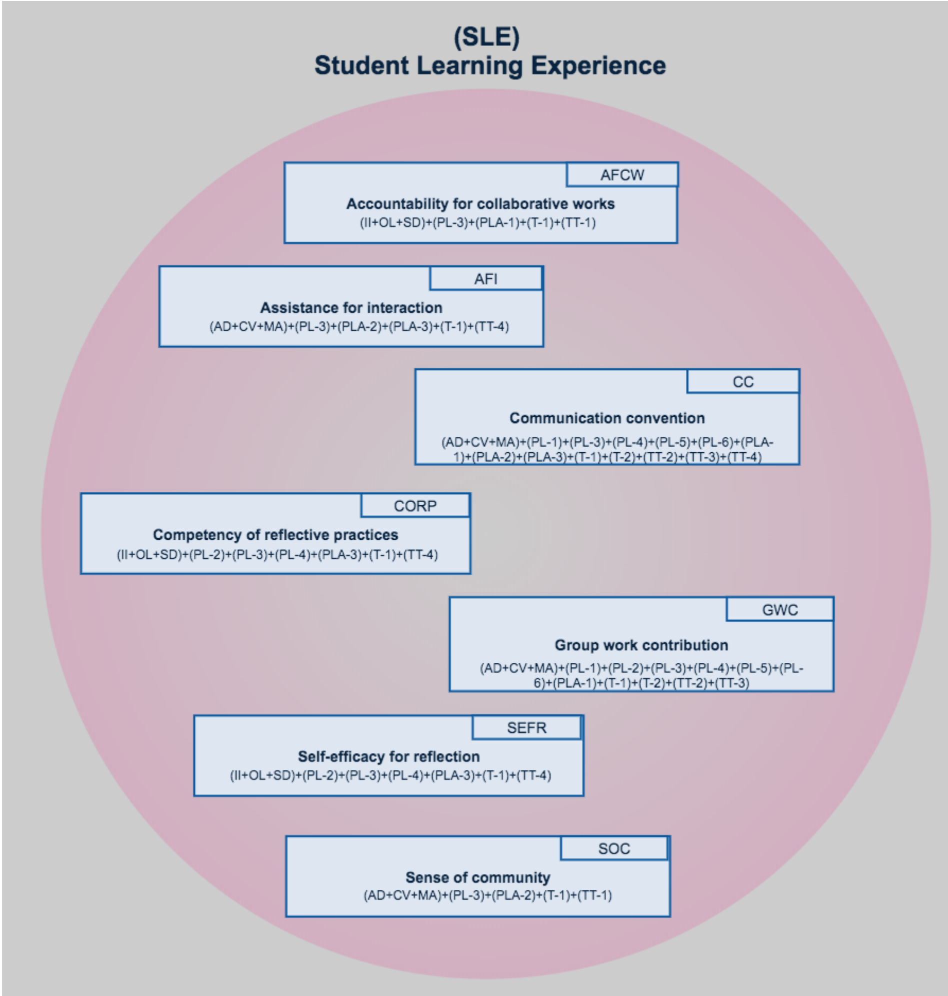


Figure 6.4: Student learning experience

6.5.1 Accountability for collaborative works

Peer learning is productive if students grasp their responsibilities in working with each other (Prøitz 2010). The results of thematic analysis in chapter 5 and factor analysis in chapter 4 indicate that accountability for collaborative work entails students being conscious that interoperability is achieved depending on their own responsibilities for giving valued comments and opening their minds, together with being willing to help others with full support. All online students have the responsibility to express their own ideas and experiences (Daves & Roberts 2010). Each person must develop his/her own self to support others who may be of different age, educational background and profession. Not only taking responsibility for working together, everyone must make a priority of participating in orientation for understanding the details clearly, including the roles and responsibilities of oneself and of other students. In addition, students also need to know the roles and responsibilities of the teaching team in order to understand the expectations of teachers, the objectives outline and timeline of each unit, the purpose of the individual and group learning activities, assignments and assessment tasks. Peer learning activity and participation in orientation is indispensable. When everyone is accountable for collaborative work with others, students continue to interact with each other after participating in orientation. Each of them has a different strength of relationship with other students. Some students have known each other or studied together before, while others may not know each other. Students who have good relationships with each other will generally have more frequent interaction than students who had no previous relationship with each other. Also, the teaching team has a responsibility to support student learning particularly online peer learning (Wang 2010). Peer learning activities are supported by the teaching team using technology both synchronously or asynchronously (Hernández-Ramos 2004). Significantly, interactions rely on technology that is used to provide both synchronous response between students and teachers, and asynchronous response between students. Students interact with the teaching team synchronously by using virtual Collaborate sessions with face-to-face two way interaction for giving and getting feedback or answers immediately. Students are able to interact with each other asynchronously by using the discussion board for posting comments according to their own interests (Ng, Cheung & Hew 2012). From the perspective of the teaching team and the students, it is found that online students took more responsibility for learning than those studying in classroom. They were free to learn at the time that were convenient for them, for example, during free time after work or when free from family obligations. Some had also no experience in online learning and might not have understood the purpose of certain aspects of online learning especially the sharing of learning experiences. However, after students attended the orientation through MyLO and understood how they should do collaborative assessment tasks in accordance with the teaching team's expectations, they were able to be accountable for giving feedback and supporting each other. This student learning experience was great.

With consideration of the intrinsic improvement, orientation to learning, and skill development together with orientation participation based on interaction with technology affordances and the teaching team's expectations, students are able to become accountable for collaborative work. For example, students improved their accountability for collaborative work by doing intrinsic activities while giving feedback any time that they posted on the discussion board. Also, they paid attention to orientation with understanding what they did for their assessment task and booked their available time for discussion in virtual Collaborative sessions. Their assessment tasks and group discussions were monitored and tracked by the teaching team for their learning progress.

Overall, the recommendation for improving 'accountability for collaborative works' is significant by the above consideration.

6.5.2 Competency of reflective practices

Reflective practices entail students giving feedback and getting responses from peers. Moreover, assessment of feedback information was monitored for idea construction (Garrison 2003). The result of thematic analysis in chapter 5 indicates that from the perspective of the teaching team and students, competency of reflective practices is presented that questioning is a challenge to the reflective practices for engaging and sharing expressive critical thinking. The relationship between students led to reflective thinking. However, students were not going to be reflective if they were not open-minded.

With the consideration of the intrinsic improvement, orientation to learning, and skill development together with orientation participation, reading and writing, and questioning based on motivation with technology affordances and student encouragement, students are able to attain competency in reflective practices. For example, students improved their 'competency of reflective practices' by being responsible for communication and interaction and responding whenever someone else posted. When they read posts and apply their judgment, they are able to understand the opinions of others and then respond on the discussion board as well.

Thus the recommendation for improving 'competency of reflective practices' is significant by the above consideration.

6.5.3 Self-efficacy for reflection

Students should be able to extend their valuable and constructive ideas and beliefs to complete tasks; they must be motivated and persuaded by others from among fellow students and teachers. Reflection is important for questioning and interactive writing.

The results of the thematic analysis in chapter 5 indicated that the factors which demonstrate a close relationship with self-efficacy for reflection are students' critical thinking and critical thinking for idea clarification. Students are able to improve their learning experience depending on the accountability of critical thinking and their willingness to communicate and interact with each other using appropriate technology. Moreover, students and teachers had the same opinion; online learning is a challenge to help each other and also create a great opportunity to learn and share experiences with each other. It relies on the support of teachers and students. Students were able to post valuable comments under the structure and purpose of the study.

With the consideration of the intrinsic improvement, orientation to learning, and skill development together with reading and writing (for questioning), orientation participation, and questioning based on motivation with technology affordances and student encouragement, students are able to attain the self-efficacy for reflection. For example, students improved their 'self-efficacy for reflection' by participating in the introduction of an orientation to understand the rules and responsibilities. Importantly, students have to read posts and create a relevant response with understanding and meaningfulness on discussion boards. Also, it was a great benefit for students to understand and get answers immediately in face-to-face discussion during the online meetings of virtual Collaborate sessions scheduled by the teacher. These build continued relationships for students who are not willing to help at only that time but also for next time. This was bolstered by encouragement from the teaching team, and appropriate technology was used for direct impact on the level of self-efficacy for reflection.

This means that the recommendation for improving 'self-efficacy for reflection' is significant based on the quality of reading and writing together with questioning. Self-efficacy for reflection was able to contribute great motivation for students to be conversant in reflection and in turn to encourage other students. If the process of reading and writing with questioning is guided clearly, students are able to improve their self-efficacy for reflection.

6.5.4 Assistance for interaction

Social interaction influences cognitive improvement, and is an important element of the learning process (Duchesne 2013). The result of social network analysis and factor analysis (in chapter 4), and thematic analysis (in chapter 5) indicate that assistance for interaction requires high level of concentration and attention around that, it is important to have intellectual curiosity for others' opinions in order to stimulate and increase interaction. Both the teaching team and the students found that students were expected to interact with each other by reading and answering according to the guideline of the learning activity. Student social relationships can be tracked on the online discussion board of the learning management system (LMS). Different supports are influenced by different relationships (Carceller, Dawson & Lockyer 2015). Social network analysis demonstrates the network of student interaction, with messages shared on the discussion board (Carceller, Dawson & Lockyer 2015; Rabbany et al. 2014; Rabbany, Takaffoli & Zaïane 2011). The discussion board was one place where student interaction as a social support. The strength of students' relationships also influenced their interaction. Moreover, students continued to be encouraged to interact and respond to questions by sharing ideas.

With the consideration of the assistance for interaction, communication convention, group work contribution, and sense of community together with orientation participation based on communication and motivation by technology affordances and student encouragement, students are able to attain the assistance for interaction. For example, students improved their 'assistance for interaction' by respecting other people's beliefs when posting and giving feedback to each other. Although students might not get any response immediately after posting, they could communicate with motivation and share their different experiences. They also participated in orientation with high reflection for further communication with meaningful content.

Thus, the recommendation for improving 'assistance for interaction' is significant by the above consideration.

6.5.5 Communication convention

The exchange of knowledge between sender and receiver is regarded to communication (Downes 2006). Communication is one attribute of social learning

(Shum & Ferguson 2011) and understanding communication is important for creating community (Wenger, Trayner & de Laat 2011b). The result of social network analysis and factor analysis (in chapter 4), and thematic analysis (in chapter 5) indicates that communication convention can assure that students are relaxed, and can contribute to the communication. Furthermore, mutual respect for each other's opinions makes communication smooth and stimulates collaborative participation and continuous communication. In the view of the teaching team and the students, students learnt how to communicate with others by reading and giving feedback on others’ work, especially between two students. The teaching team supported students’ professional practices by responding to them. Also, virtual Collaborate sessions were set up for student verbal communication in accordance with the assessment task. However, some new students felt it was hard to communicate.

With the consideration of the assistance for interaction, communication convention, group work contribution, and sense of community together with group task, orientation participation, questioning, posting, and face-to-face meeting based on interaction, communication and motivation by technology affordances, technology integration, teaching team preparation with the use of technologies, and student encouragement, students are able to attain the communication convention. For example, students improved their ‘communication convention’ with the teaching team’s assistance with the preparation of appropriate technology, including a discussion board for communication among students and virtual Collaborate sessions for communication between students and between students and teachers. Importantly, students need to realise the importance of communication for continuous feedback by responding to each other.

Therefore, the recommendation for improving ‘communication convention’ is significant by the above consideration.

6.5.6 Group work contribution

Regarding group work contribution, the degree of relationship between group members is an important part of maintaining group cohesion (Muller et al. 2003). This is especially true when the group members have to interact with each other through available channels periodically. The result of social network analysis (in chapter 4), and thematic analysis (in chapter 5) indicates that students worked with peers as their team. Small groups of students were more comfortable in supporting each other. Moreover, student interaction needed the support from their peers when they were assigned to group work. Obviously, students who did not commit to complete interactive activities would also leave the online group work easily.

With the consideration of the assistance for interaction, communication convention, group work contribution, and sense of community together with group task, orientation participation, questioning, posting, and face-to-face meeting based on interaction by technology affordances, technology integration, and teaching team preparation with the use of technologies, students can attain the group work contribution. For example, students improved their ‘group work contribution’ by showing commitment to post messages on topics of interest at least a few times weekly on the discussion board.

Therefore, the recommendation for improving ‘group work contribution’ is significant by the above consideration.

6.5.7 Sense of community

Communities of practice entail strong interconnections with knowledge creation (Wenger 2000). The result of social network analysis and factor analysis (in chapter 4), and thematic analysis (in chapter 5) indicates that in order to work together or get involved in society or a community, students have to acknowledge their differences and believe in the ability and experience of the individual. With mutual understanding, students are able to create a good sense of community for the purpose of working together. As a result of the students’ interaction with each other on the discussion board from the beginning until the end of the semester, the frequency of interaction did not influence the improvement of the learning experience. Students were encouraged to interact with each other with one-way or two-way communication. While each person was different in terms of education and work experience, everyone wanted to work together in an ethical manner using appropriate technology. Synchronous technology was required for immediately real time response, but asynchronous technology was available for communication as well (Hernández-Ramos 2004). Not only the relationship between factors, but also the deep information gained from interviews with both teachers and students suggests that when students understood the expectations of the teacher and had an understanding of the social involvement, the student learning experience was enhanced.

Considering of the the assistance for interaction, communication convention, group work contribution, and sense of community together with orientation participation based on communication by technology affordances and the teaching team's expectations, students are able to gain a sense of community. For example, students improved their 'sense of community' by cultivating understanding in working together. Students needed to interact with each other by posting messages on topics of interest or related assigned tasks. Also, they replied to others who gave them feedback on the same topic. Student who worked in the same group had the opportunity to communicate with each other through the discussion board and interactive virtual Collaborate sessions. Communication within the community was based on understanding the different experiences and beliefs of individuals (Skalicky & Brown 2009). The group discussions including student feedback were monitored and tracked by the teaching team to get a sense of community progress.

Thus, the recommendation for improving 'sense of community' is significant by the above consideration.

Students can get the most significant seven learning experiences if they realise which more or less significant factors influence each of them, along with the consideration of peer learning attributes (interaction, communication, and motivation), the teaching team and technology.

6.6 Chapter summary

This chapter had interpreted and discussed the results that were obtained from the quantitative data analysis in chapter four and the qualitative data analysis in chapter five. The chapter presents student related factors, organization and delivery for online peer learning, and student learning experience.

Student related factors consist of the intrinsic improvement, orientation to learning, skill development, assessment driven, conversations, and moral awareness.

Organization and delivery for online peer learning considered peer learning activities together with peer learning attributes, the teaching team, and technology. Peer learning activities consisted of face-to-face meeting/session, group task (including assessment), orientation participation, posting, questioning, and reading & writing (for questioning). Working for peer learning activities was related to peer learning attributes, with the support of the teaching team and technology. Peer learning attributes include interaction, communication, and motivation. The teaching team's responsibilities consist of expectation, preparation, using technologies, and encouraging students. Also, technology includes both affordances and integration.

The student learning experience includes accountability for collaborative works, competency of reflective practices, self-efficacy for reflection, assistance for interaction, communication convention, group work contribution, and sense of community. Of these, the first three are influenced by intrinsic improvement, orientation to learning, skill development, and the last four are influenced by the assessment driven, conversations, and moral awareness.

Chapter 7: Research Findings

7.1 Introduction

This chapter discusses the research outcomes that have been obtained from the undertaken research. These research outcomes have been identified as the key results that answer the research questions.

This chapter is divided into the following sections:

- Section 7.2 restates the research questions and objectives driving the research;
- Section 7.3 presents the four key findings of the research in relation to the student learning experience, the technology-supported aspect, and peer learning activities.
- Section 7.4 directly answers the research questions in the overall context of the research.
- Section 7.5 provides a summary of this chapter.

7.2 Research Questions and Objectives

This research aims to:

1. Investigate the role and usefulness of peer learning activities in an online environment for contributing to the student learning experience;
2. Implement a set of technology-supported peer learning activities and evaluate their impact on the learning experience in an online environment; the set includes:
   - The use of asynchronous discussion tools to support higher-level of student-student and student-teacher interactions
   - The use of a face-to-face virtual room application as a synchronous tool for student engagement and conversation;
3. Generate a framework for supporting online peer learning unit design that optimises the student learning experience.

The following research questions and associated research objectives were designed to meet the research aims.

Research question 1: What factors promote or hinder peer learning activities in an online environment?

> Objective 1: To determine the enabling elements of peer learning activities in online environment
>
> Objective 2: To determine the impact and position of the teacher on peer learning activities in online environment

Research question 2: How do technology-supported peer learning activities in an online environment impact on students' learning experiences?

> Objective 3: To determine what influences interactions when engaging in peer learning activities in online environment
>
> Objective 4: To determine what the affordances of technology are that contribute to the community development of peer learning activities in online environment

7.3 Presentation of the Research Findings

This section will present the research findings in relation to student learning experiences, technology-supporting roles and peer learning activities:

This exploratory research investigating the role of technology-supported peer learning activities in enhancing students' online learning experiences has produced a number of key findings. These have emerged from comparative analysis of the educational units studied both before and after their redesign to support the learning experience.

1. The first key finding involves examination and analysis of the interdependencies amongst three peer learning attributes.
2. The second key finding identifies six student-related factors and explores their influence on peer learning activities.
3. The third key finding involves the impact and role of the teaching team on peer

learning activities, learning resources, and the learning environment.

4. The fourth key finding demonstrates the importance of understanding the role of technology affordances and how they facilitate and support integration of technology into peer learning activities.

All of these key findings are related to substantive changes in student learning experiences intimately related to technology supported peer learning activities (see figure 7.1).

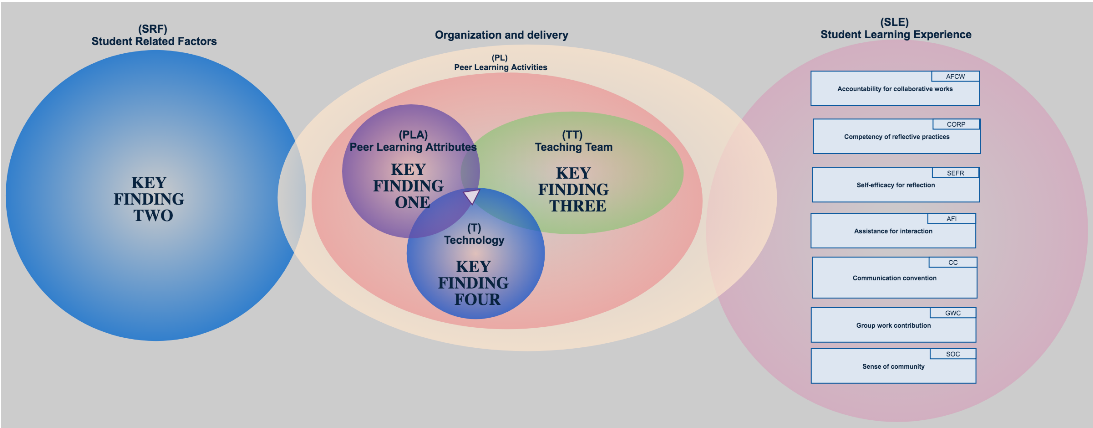


Figure 7.1: Four research key findings

7.3.1 Key Finding One

Key Finding One – The nature and importance of the interdependence among the three peer learning attributes (interaction, communication, and motivation) on the learning experience of students

When students have their critical thinking presented and share their active ideas, other students (peers) are challenged and encouraged to use reflective practice without feeling direct pressure. Consequently, the peer interaction was increased as a result of both critical thinking and reflective practice, all of which help improve the learning experience of students.

This key finding gives teachers and the teaching team a focus to ensure that three peer learning attributes (interaction, communication, and motivation) are linked when setting up peer learning in an online environment. When teachers want to improve the learning experience of students, they must foster good relationships with their students by encouraging them to interact with each other and to send messages or ideas to each other during their communication.

In relation to the development of an exchange of learning experiences between students, there are three related peer learning attributes including interaction, communication, and motivation as follows.

Interaction: The two most important aspects are the strength of relationship between students, and the frequency of their interaction. Each aspect directly influences the learning experiences and includes accountability for collaborative works, group contribution, and communication convention.

The results of interactions depended on how strong the relationship between students is. Also, the redesign succeeded in improving peer interaction and the shared learning experience, depending on the strength of relationship. A good relationship between people, not only among students but also between students and teachers, can lead to successful conversation. Then, students are challenged to criticize others' ideas without feeling pressured.

To investigate the level of peer-interaction, it was found that postgraduate students, who have more online learning skills than undergraduate students, generally have more interaction with each other. However, assigned tasks are another important factor that motivates students to interact during the learning timeline.

After separating the individual task and the group task, the students worked together on the group task and they appeared to have less communication or interaction with low feedback reflection, depending on the strength of their relationship. However, a large amount of interaction between them does not mean that it is the great or high quality interaction. Interaction is considered to be closely related to communication. The quality of the content exchanged during the communication between them will be an important indicator of the development of the student learning experience. This is discussed in the following section.

Communication: The two most important aspects of communication are the perception of quality of content exchanged and the perception of aims. Each aspect directly influences to the student learning experience, including sense of community, assistance for interaction, and communication convention.

The content during communication between each other reflected the common interest and individual interests. It was important to communicate effectively based on the contents of data exchanged between them and their aims of communications. If the content is of interest and regards the same subject, it is likely to maintain the intensity of the relationship, reflecting enthusiasm and personal needs. Also, they continued to communicate and interact together, sharing their own ideas. This may be a direct benefit to students' online learning and can also be instrumental in their future work. Challenging students' peer learning activities helps make their messages significant with a good sense of communication and modelling of engagement, although several students highlighted the diversity of professional practices. However, it remains unclear from the findings what the significant messages should be during interaction.

Motivation: The two most important aspects of motivation are the willingness to initiate and the willingness to provide feedback. Each aspect of directly influences the student learning experience including self-efficacy for reflection, competency of reflective practices, assistance for interaction, and communication convention.

Voluntary interaction between students starts with building a relationship. Also, they can maintain continuity by providing constructive feedback from their own experiences. There is no right or wrong feedback, but the goal is to achieve right and valued understanding with each other. When students were interested in the same thing, this encouraged their communication and interaction to yield mutual benefits. This is extremely important to develop their own learning experiences. Students were more motivated by the teaching team or peers in relation to the person who had good relationship with them. However, well interaction was not shown the actual contribution of students' learning experience. Making sense of message, deeper perception of ideas and contributions, and explanation of ideas during communication significantly influenced the improvement of the learning experience.

7.3.2 Key Finding Two

Key Finding Two – The identification of student related factors and their influence on peer learning activities

This key finding focuses on students' own accountability, skill development, and orientation attendance. The students who showed their own critical thinking would have the responsibility to work together. Also, they understood the importance of interactive feedback, which had an influence on any increase in their peers' reflective practice. The increase of understanding, perception, and performance of accountability for peer learning activities definitely affected the improvement of students' learning experience.

Student related factors consist of intrinsic improvement, orientation to learning, skill development, assessment driven, conversations, and moral awareness.

Intrinsic improvement concentrated on understanding of accountability, perceptions of each student's capability to be accountable, and performance of accountability for peer learning activities.

Understanding of accountability: Students should know the purpose of peer learning and understand how they should interact with each other on the discussion board (asynchronous technology for student-student interaction) or in online tutorial sessions (synchronous technology for student-teacher interaction).

Perceptions of the capability to be accountable: Students should understand their own learning experience and optimal learning time based on the time they spend with work and family. Ideally, two students will be comfortable in mutual conversation as instant response through face-to-face online tutorial sessions. It is also not necessary to raise one's hand or stop the other person during conversation.

Performance of accountability for peer learning activities: students should have good peer interaction by posting and responding on the discussion board, setting up notifications for feeding any updates to their personal emails. Technologies are integrated for supporting learning activities and sharing learning experiences (e.g. with a direct feed from the discussion board to one's email address, without necessary login to system). Thus, peers are able to support each other without the help of the teaching team. However, notifications is one of the biggest downsides of technology supported peer learning activities. Students must set up the notifications for reminding them to further respond to their peers.

The increase of understanding, perception, and performance of accountability for peer learning activities is important because it highlights changes in individual beliefs and reflections on the value of accountability during peer learning, as well as performance during interactive group discussion and engagement. This is of interest when students' intrinsic improvement considers not only the value of belief and reflection, but also interactive discussion and engagement.

By considering intrinsic improvement influencing peer learning activities for student learning experience, orientation participation is required for accountability for collaborative works, assistance for interaction, and communication convention. Also, group task (including assessment), reading and writing (for questioning), orientation participation, questioning, posting, and face-to-face meeting are required for communication convention. It was found that the work group is looking for cooperation based on individual acts of accountability in order to achieve mutual success. Each person needs to read and write during the interaction and communication as well as offline, by posting messages on the discussion boards and online by face to face meetings with each other through virtual Collaborate sessions.

Orientation to learning Clear instruction during orientation consists of the teaching team's expectations, assessment, tasks (individual and group), the timeline, and learning activities including video presentations. It is useful for student understanding of how they should learn and practice accordingly. Also, student thinking at the beginning is significant for the consequence of learning especially in an online environment. Sharing one's own ideas or experiences can happen based on the way one understands the benefits of peer learning and how it supports learning. Then, critical reflection encourages the students in their own professional practices.

By considering how the orientation to learning influences peer learning activities for the student learning experience, orientation participation is required for accountability for collaborative works, sense of community and assistance for interaction. Both reading and writing (for questioning) together with orientation participation are required for self-efficacy for reflection. Also, group tasks (including assessment), orientation participation, questioning, posting, and face-to-face meetings are required for group contribution and communication convention. Moreover, both orientation participation and questioning are required for competency of reflective practices. The orientation led to understanding between teachers and students who worked in the same direction for the achievement of learning objectives. After students participated and became aware of the importance of the orientation, they were able to understand the expectations and needs of teachers, as well as the benefits of the group work including how technology is used as a tool for peer learning. Particularly during group work, teachers assigned tasks and evaluated the cooperation of the students for further critical thinking and the exchange learning experiences with each other.

Skill development focusing on thinking, reading and writing skills. The aims of effective instruction for assessment tasks were engaging students to improve their learning skills (*especially thinking, reading and writing*) and achieve a level of interest in unit content to stimulate the exchange of ideas on particular areas of interest.

In considering skill development focusing on thinking, reading and writing skills as it influences peer learning activities, reading and writing (for questioning) together with orientation participation are required for self-efficacy for reflection. Also, both orientation participation and questioning are required for competency of reflective practices. The students who were assigned to do assessment tasks required the essential skills of thinking, reading and writing. When students wanted to post any messages, they began to think what they wanted to communicate to other students. Then they had writing skill to communicate with other students by posting messages. After that, students who read the messages made use of their reading and thinking skills to understand and interact on the topic of interest. This is a process of continued communication and interaction.

Assessment driven Redesigned learning activities for the assessment task improved individuals understanding and perception, as well as their capability of being accountable for peer interaction (for example, participation online and posting are part of students' assessment task, and peer interaction is also based on the assessment task). Specifically, it would appear to be essential that students are able to engage content at that time and that they be able to understand content including the assessment tasks, in order to build on their learning experience they have gained.

By considering assessment driven as it influences peer learning activities for the student learning experience, a group task (including assessment), orientation participation, questioning, posting, and face-to-face meetings are required for group contribution. Understanding the content that students want to learn, it is important to measure whether students achieved the learning objectives or not. The group needs to learn how to help each other. After students passed the orientation, they continued to work on the assessment tasks following the course timeline. They were also able to reinforce peer learning with face-to-face meetings through virtual Collaborate sessions.

Conversations The teaching team used technology for supporting the redesigned learning activities and enhancing student communication and interaction (not focusing on frequency of interaction) based on peer interaction. However, students could not communicate with each other without the teaching team in virtual Collaborate sessions, because they were not confident to be a moderator as the teaching team.

By considering how conversations influence peer learning activities for the student learning experience, the group task (including assessment), orientation participation, questioning, posting, and face-to-face meetings are required for a group contribution. Also, orientation participation is required for assistance for interaction. Although students passed the orientation understanding their roles, the interaction with discussions they were part in could not be successful due to the lack of a moderator. In any case, the quality of the message during communication is more important than the frequency of interaction. If the messages or contents are potential, students are able to get the benefit of their learning experience. However, it is difficult to explain clearly what the quality of the content exchanged is.

Moral awareness Students are challenged to access and judge other students' ideas. Their answers are not right or wrong. The teaching team wanted them to justify their unbiased thinking. Norms of peer support are indicated by praise or agreement. Some students originally made posts in disagreement. Everyone has own beliefs and personal experiences that are more or less different. Some students are concerned about the negative comments of others. Thus, this blocked the exchange of learning experiences together.

Moral awareness influences peer learning activities for student learning experience, and orientation participation is required for a sense of community and assistance for interaction. Both reading and writing (for questioning) together with orientation participation are required for self-efficacy for reflection. Also, the group task (including assessment), orientation participation, questioning, posting, and face-to-face meetings are required to fulfill communication convention. Although students had different opinions, they responded by showing their ideas while giving reasons for disagreement. The ideas shared with feedback supported student learning to develop their skills and opening opportunities for peer learning through group work.

7.3.3 Key Finding Three

Key Finding three – The impact and role of teaching team on peer learning activities

This key finding gives teachers and the teaching team a focus to be aware of their role to encourage and support the peer learning activities of students in order to help them to succeed in peer learning. Especially, they have to make their expectations clearly to students, to prepare their teaching style and materials, to use appropriate technologies, and to encourage student engagement as much as they can.

The teaching team worked according to teaching activities that supported students for peer learning activities. These teaching activities consist of clarifying expectations, teaching preparation, using technology, and encouraging students as follow

Clarifying the expectations regarding peer learning and the assessment tasks for students. Peer learning activities are described to show the role of students supported by the teaching team. Moreover, when clarifying the expectations on the assessment tasks the detail of each task together with the unit timetable and the due date are revealed. Scope and a task list are also presented to make sure that students can understand each step.

Teaching preparation consists of making available learning materials, learning environment, and learning channels ready for supporting students, which includes setting up discussion boards and tutorial sessions based on students' available time.

Especially, the learning environment is especially important for facilitating students work on individual and group activities.

Using technologies (asynchronously and synchronously) including the use of lectures with presentations. The teaching team tried to provide technology to support students in an appropriate way. For example, face-to-face synchronous communication with the teaching team is useful for asking any questions, and the discussion board for students' interaction together.

Encouraging student participation and responses to each other. The teaching team initiates some posts for further posting by student to each other. In addition, the teaching team also stimulate student thinking on unit assessment, as thinking skills are important for students to improve their own ideas and experiences, although of course they sometimes have different ideas.

The performance of teaching team activities should be supportive and motivated. The teaching team understands that students have different learning experiences and learning times. Thus, learning resources and learning environment were set up based on students' available time. However, it was also found that students were sometimes required to interact with only the teaching teams, despite the redesigned unit. However, students who are motivated or encouraged by the teaching team have more opportunities for making communities with other students as well. Also, the guidelines for good discourse and critical self-reflection were modelled for student engagement and students' explanations of ideas. At the same time, the teaching team was also able to work as a facilitator or motivator for student engagement and reflection.

7.3.4 Key Finding Four

Key Finding four – Understanding the role of technology affordance and integration on peer learning activities, learning resources, and learning environment

This key finding gives teachers and the teaching team a focus to understand the importance of technologies, specifically how to select the appropriate synchronous or asynchronous technologies according to available learning resources and the learning environment.

The teaching team encourages students to use integrated technologies for supporting learning activities and sharing learning experiences. The teaching team knows the objectives of peer learning and understands how they should support and motivate students to interact with each other on the discussion board (asynchronous technology for student-student interaction) or in online tutorial sessions (synchronous technology for student-teacher interaction). However, it was also found that students still required the virtual Collaborate sessions to be moderated by the teaching team even for the redesigned units. Moreover, it remains unclear from the findings if some students would prefer to be moderators, and what they should do accordingly.

Another important finding is that, face-to-face talking in virtual Collaborate can cause peer interaction to improve if the face-to-face collaboration is as natural as in a real classroom.

Before redesigning the units, the teacher didn't consider the various purposes of synchronous and asynchronous features and functions of technology. Ideally, these would be facilitated by the teaching team and used by students in support of students' critical and reflective thinking. Synchronous features and functions of technology influenced students' moral awareness for disagreement with assessment of other students' posted messages. When building a significant learning experience for students, it was necessary to offer them real time face-to-face communication in the online environment so that their reflective ideas perceive other would gradually increase. Students used asynchronous features and functions of technology in flexible but compulsory online participation, and they were easily made accountable to their peers for their own interaction and the opportunity for peer learning.

Overall, "the framework of recommendations for enhancing student learning experience in online peer learning" (shown in figure 7.2) has been produced in accordance with the four key findings. It highlights how to enhance the student learning experience via participation in technology-supported peer learning activities. The framework also illustrates how the teaching team can optimise the orientation, teaching activities, learning activities, selection of appropriate technology tools, and individual and group assignments and how these decisions link to the levels of interaction between students and between students and teachers.

This chapter presents not only the four key findings from the case study, but also provides a framework that other researchers can use. Thus they will be aware of the fact that there are a range of factors and potential interrelationships but the researcher does not know, for example, moral awareness will be the very significant factors for other researchers even though it was not the most significant factor of this research.

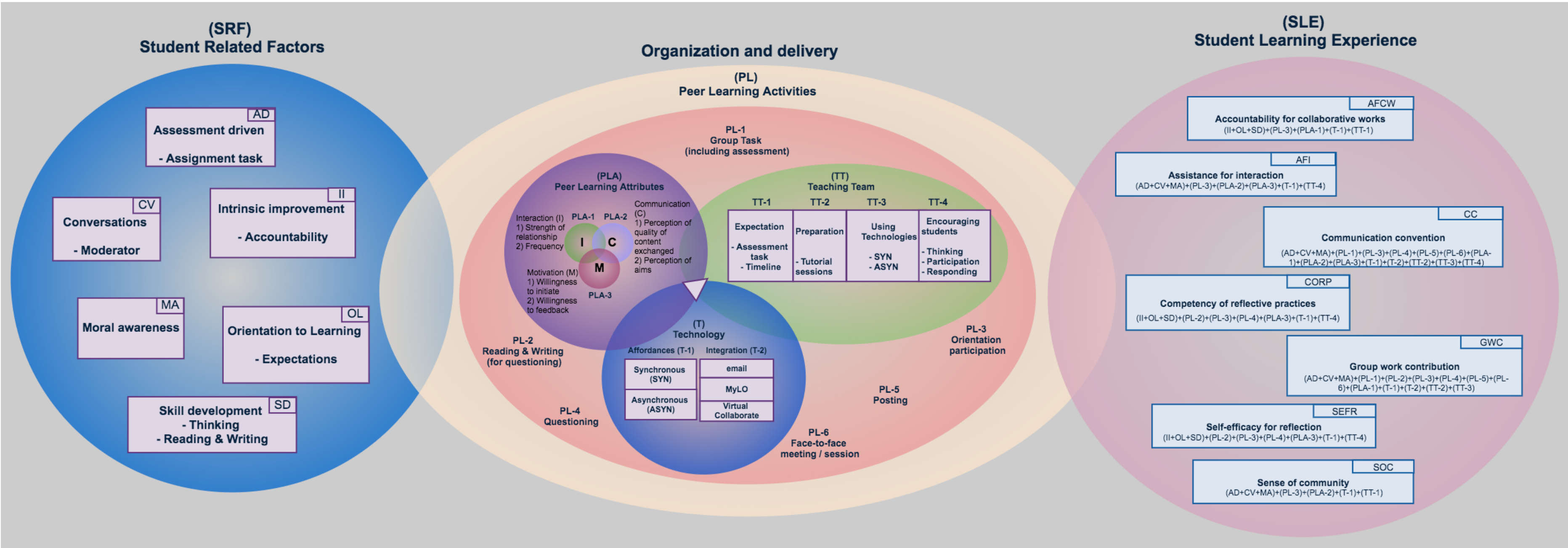


Figure 7.2: The framework of recommendations for enhancing student learning experience in online peer learning

It should be noted that figure 7.3 is not a statistically based model, but rather a demonstrative one that was created to present scenarios of possible incremental development of the student learning experience through the life cycle of peer learning. Starting from S1a: firstly, if the operations for the framework of online peer learning have been done continuously, the direction of development of the student learning experience through the life cycle of peer learning will follow the path of S2b. Secondly, if the operations in the framework of online peer learning have been done normally, the direction of development of the student learning experience through the life cycle of peer learning will follow the path of S1b and continue further on the path of S1c. Lastly, if the operations for the framework of online peer learning have been done abnormally, the direction of development of the student learning experience through the life cycle of peer learning will follow the path of S2a.

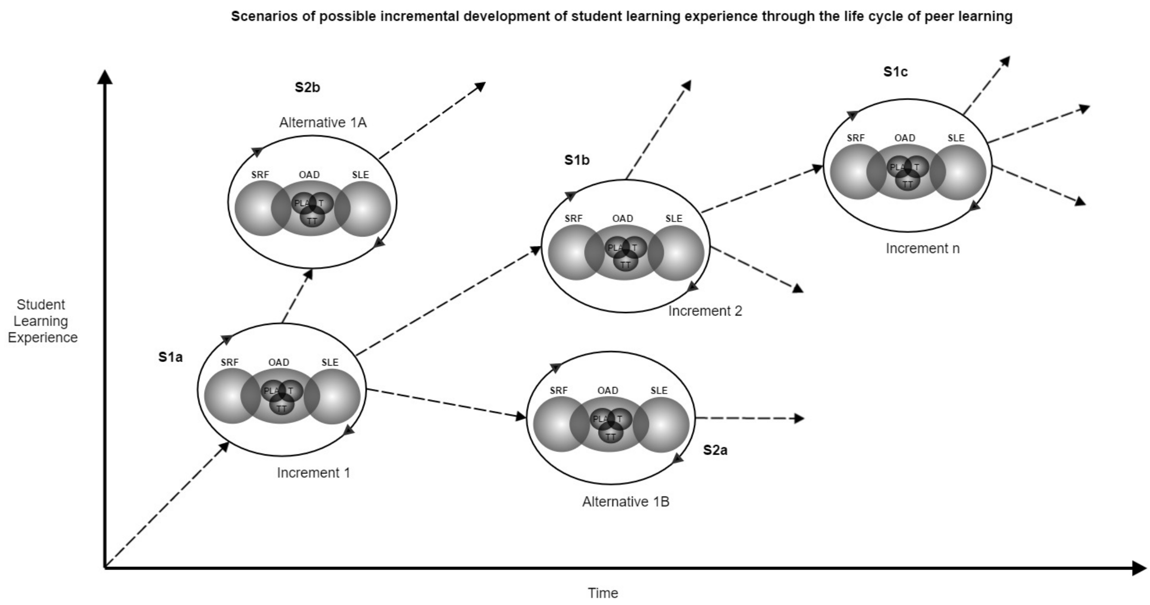


Figure 7.3: The scenarios of possible incremental development of the student learning experience through the life cycle of peer learning

7.4 Answering the Research Questions

This section presents a discussion of the research findings in relation to the aims of the research and the research questions. The aims of the research were to:

1. Investigate the role and usefulness of peer learning activities in an online environment for contributing to students learning experiences;

2. Implement a set of technology-supported peer learning activities and evaluate their impact on students learning experiences in an online environment;

3. Generate a framework for supporting online peer learning unit designs that optimise students learning experiences

7.4.1 Question One – What factors promote or hinder peer learning activities in an online environment?

The objective of this question was to:

Objective 1: To determine the enabling elements of peer learning activities in online environment

To answer this question, the student related factors must be understood. It is important to understand how peer learning activities are influenced differently by each student related factor. Significantly, according to key finding two, the identification of student related factors and their influence on peer learning activities, different students affect peer learning activities, especially group work. Looking at this in terms of the factors that are relevant to the students, the student related factors are that students act on their own initiative and they do not depend on other students directly. However, intrinsic improvement, orientation to learning and skill development will promote peer learning activities if students are ready to understand how best to perform them. The preparation of students with recognition and engagement for their own responsibility, for example, they participate in orientation, or work assignments on time through the right technology, has the potential to influence the promotion of peer learning activities. The assistance for interaction, communication convention, group work contribution, and sense of community can promote peer learning if students and their peers have mutual support for assessment driven, conversations, and moral awareness. Students and their peers work together and affect each other. Students not only are responsible for their own acts, but also need to understand the role and potential of their follow students, because everyone must work together, engage with the content, encourage each other, give feedback, and submit assignments using critical thinking through reading and writing. However, students are not able to serve as moderators like the teaching team in virtual Collaborate sessions. Moreover, enhancing student communication and interaction does not focus on frequency of interaction but perception of quality of content exchanged is significant based on modelling of good practices by teaching team.

Objective 2: To determine the impact and position of the teacher on peer learning activities in online environment

The teacher is responsible for teaching and also is responsible for preparing the students with learning environment and learning resources with available technology. Importantly, role of teacher is to define a model to conduct good practice and critical thinking in order to achieve learning objectives. Significantly according to key finding three – the impact and role of teaching team on peer learning activities, the significant role of teaching team consists of 1) define the expectation with assessment task and timeline 2) preparation including tutorial sessions 3) using technologies with synchronous and asynchronous features and 4) encouraging students for thinking, participation, and responding. These are extrinsic improvement that has made a great impact on peer learning activities. Moreover, modelling of good practices and critical thinking are completely provided to students therefore students are able to help and support each other with sharing their own ideas and comments with each other. However, it is not clear from the findings how teacher and teaching team encourage students to prepare themselves for being moderator during conversations.

7.4.2 Question Two – How do technology-supported peer learning activities in an online environment impact on students' learning experiences?

The objective of this question was to:

Objective 3: To determine what influences interactions when engaging in peer learning activities in online environment

The relationship between students influences students' interactions with each other. Whenever students have a good feeling with each other, or have a good relationship with each other then the interaction occurs easily and friendly. However, interaction for exchanging of experience in the topics of same interest is able to encourage anyone who is interested to express their own opinions and express their understanding of others' opinions concurrently. Obviously, students are able to engage for participation depends on the support of the teaching team and the technology used. Significantly, according to key finding one, the nature and importance of interdependence among the three peer learning attributes (interaction, communication, and motivation) does not tie in the frequency of interaction, but in the perception of quality of the content exchanged, and the perception of aims from communication is also significant. In addition, the capacity of the individual for beginning and reflecting on peer communication and peer motivation has a significant work in enhancing the learning experience of students.

Objective 4: To determine what the affordances of technology are that contribute to the community development of peer learning activities in online environment

Technology is used to facilitate student learning. It is used for supporting students' critical thinking and readiness for interaction, as well as for sharing their own experience with each other. Significantly according to key finding four (understanding the role of technology, affordance and integration on peer learning activities, learning resources, and learning environment), the interaction between students during peer learning activities worked more effectively when they use technologies that supported asynchronous communication (for example, email and the university learning management system named MyLO), while the interaction of the teacher and student worked more effectively via technologies that supported synchronous communication (for example, virtual Collaborate sessions). This is technology affordance. Also, technology can be integrated by combing the capability of email, MyLO and virtual Collaborate sessions for real time notification and immediate response. Importantly, technology affordance and integration influence not only student accountability for their peers but also the teaching team's modelling of good practices for community development. However, effective IT support is necessary for student engagement and interactive online learning activities in accordance with the students' willingness to use the technology.

7.5 Chapter Summary

This chapter has presented the key findings generated from the undertaking of the research and answered the research questions. The key finding were generated from the chapter 6 interpretation and discussion, while the research questions were answered in relation to these outcomes.

There were four key findings generated from this research. The first was the nature and importance of the interdependence among the three peer learning attributes (interaction, communication, and motivation) regarding the learning experience of students. The second was the identification of student-related factors and their influence on peer learning activities with six student-related factors involving intrinsic improvement, orientation to learning, skill development, assessment driven, conversations, and moral awareness. The third was the impact and role of the teaching team on peer learning activities, learning resources, and the learning environment. The fourth was understanding the role of technology affordance and integration on peer learning activities.

In answering the research questions, it was found that technology-supported peer learning activities encouraged students to engage in peer learning activities in the online environment. Regarding student related factors, all of them can promote peer learning activities if students are ready to understand how they should perform in order to improve orientation to learning, and skill development. On the other hand, student related factors can promote peer learning activities if students and their peers have mutual support for assessment driven, conversations, and moral awareness. The significant role of the teaching team consists of 1) defining the expectations for the assessment tasks and timeline; 2) preparation, including tutorial sessions; 3) using technologies with synchronous and asynchronous features; and 4) encouraging students to think, participate, and respond. It is not the frequency of interaction but the perception of quality of content exchanged, as well as the perception of aims from communication that are significant. Interaction between students during peer learning activities worked more effectively using technologies that supported asynchronous communication, while interaction between teacher and student worked more effectively with technologies that supported synchronous communication.

Chapter 8: Conclusion

8.1 Introduction

This final chapter provides a summary of the research findings and discusses the contributions that have been made. Additionally it discusses potential limitations of the research, along with identifying future opportunities for further research. The chapter contains the following sections:

- Section 8.2 provides a brief overview of the key findings that have been obtained from this research;
- Section 8.3 summarizes the contributions of this research at a substantive, methodological, and theoretical level;
- Section 8.4 covers the limitations of the study.
- Section 8.5 discusses possible future research that could be taken to expand on the current findings; and
- Section 8.6 provides a summary of this chapter.

8.2 Summary of Research Findings

This section presents a summary of the findings that were presented in Chapter 7. The four key findings for the research are as follows:

Key finding one: The nature and importance of the interdependence among the three peer learning attributes (interaction, communication, and motivation) on the learning experience of students. This finding shows that it is not the frequency of interaction, but the perception of the quality of the content exchanged that is significant. The capacity of the individual for initiating, and reflecting on, peer communication is also significant for enhancing the learning experience of students.

Key finding two: The identification of student-related factors and their influence on peer learning activities, six student-related factors can be identified as follows: intrinsic improvement, skill development, conversations, moral awareness, orientation to learning, and assessment driven. This finding shows that targeting these factors during re-design can enhance peer learning activities by stimulating improved accountability, critical reflection, an appropriate orientation to learning and improved expectations of students around skills development, learning outcomes, assessment and the use of technology. All these have been identified as contributing positively to students' learning experiences.

Key finding three: The impact and role of the teaching team on peer learning activities, learning resources and learning environment. This finding suggests that re-designs that encourage students to actively participate in peer learning without the involvement of teachers require that the teaching team clearly explain the aims, assessment, and objectives of technology-supported peer learning activities. However, the teaching team must continue to anticipate that some students will still require direct interaction with the teaching team. The student learning experience is greatly enhanced by the teaching team when resources, the learning environment and peer learning activities are communicated, structured and delivered in an integrated and holistic manner.

Key finding four: Understanding the role of technology affordance and integration on peer learning activities. This finding suggests that the interaction between students during peer learning activities worked more effectively using technologies that supported asynchronous communication, while the interaction of the teacher and student worked more effectively via technologies that supported synchronous communication. For the learning experience of students, it is also apparent that message notifications are a useful way of stimulating interaction, even when using asynchronous technologies.

8.3 Contributions of the Research

This section discusses the substantive, methodological, and theoretical contributions that have been made as follows:

At the substantive level, this research contributes a detailed case study on the role and impact of technology-supported peer learning activities in an online environment. Specifically it identifies factors relating to peer learning attributes, the role of the teaching team and the role of technology and how these interact to impact on students learning experiences.

At the methodological level, this research deployed a pre- and post- intervention over four phases to support concurrent triangulation. This approach supported the investigation of the impact of a range of factors and their inter-relationships on students learning experiences from online peer learning.

At the theoretical level, this research has produced a framework of recommendations for peer learning in educational units being launched in online environments (see figure 7.2). This framework highlights how to enhance student learning experiences from their participation in technology-supported peer learning activities. The framework also illustrates how the teaching staff can optimise orientation, teaching activities, learning activities, selection of appropriate technology tools, and student group assignments, and how these decisions link to the levels of interaction between students and between students and teachers.

The results of the research have led to the creation of a framework for enhancing online peer learning with the introduction of critical elements for online peer learning, teaching design and student experience. This research has addressed a gap in knowledge by providing a framework that includes consideration of the perspectives and contributions of both teachers and students and highlights the importance of the interaction between the two for ensuring that online peer learning achieves its intended purpose.

8.4 Limitations of the Study

The researcher acknowledges that this research has certain limitations. The limitations of the study are the scope of the research, researcher bias and lack of generalizability.

8.4.1 Scope of the Research

The research was conducted as a case study with its own aims and objectives, as presented in chapter 1 and chapter 3. This meant the research was limited by the case study that was designed and the participants' responses. The alignment of this information research meant there was little room for the researcher to control design and implementation. An illustration of the recommendation of the redesigned units is reflected in this research by the launching of redesigned units. However, the interviews were developed under the control of the researcher, and monitoring student interaction data used from the social network on the discussion board, enabling the research aims to be achieved.

The researcher made the decision to use Exploratory Factor Analysis (EFA) because of the number of retaining factors. EFA is a statistical method that is used to reduce data to be smaller as a group of summary variables. It also explores and identifies the structure of the relationship between variables. The objective of factor analysis is to reduce a large quantity of individual items into smaller one. EFA can be used to reduce the number of variables in regression patterns. Separating from the sample size, average communality and factor over determination are the most important causes of the accuracy of exploratory factor clarification (Hogarty et al. 2005; MacCallum et al. 2001).

As discussed in Chapter 3 (see section 3.7.1.3) Exploratory Factor Analysis required researcher to make various decisions, each of which influenced the solutions generated (Gaskin & Happell 2014). In addition, EFA was able to differentiate between major factors (high correlation) and minor factors (low correlation) (Hayton, Allen & Scarpello 2004). The sample size was qualified from the strength of factors and the items (Beavers et al. 2013). Moreover, the number of student respondents per item was shown in Appendix F Quantitative data analysis (stage one unit one – 26 participants for 1st survey & 24 participants for 2nd survey), Appendix G Quantitative data analysis (stage two unit one – 36 participants for 1st survey & 12 participants for 2nd survey; stage two unit two – 25 participants for 1st survey & N/A for 2nd survey), and Appendix H Quantitative data analysis (stage three unit two – 62 participants for 1st survey & 28 participants for 2nd survey; stage two unit three – 21 participants for 1st survey & 11 participants for 2nd survey).

8.4.2 Researcher Bias

Data in this work were collected during two time periods - at the beginning of the semester and at the end of it. By so doing, the researcher could observe an emerging direction of students' learning experiences over a period of time. Obviously collecting data this way could result in a drop-out bias (Malone, Nicholl & Tracey 2014) as presented in chapter 3.

8.4.3 Lack of Generalizability

Case study research is often linked with a lack of generalizability. This is because case study research is bounded by the implementation of redesigned units. It would be interesting to have a larger population of participants from another faculties or universities with experiences in different learning environments and various university technologies. However, this research may provide some guidance with the findings presented on how to improve the student learning experience through online peer learning. Also, the research has taken the opportunity to enhance students' interaction during online peer learning.

8.5 Future Research

This research investigated the impact of peer learning in an online environment over a two year time period. Given that the redesigned unit was proposed a guide to improve student interaction and engagement for enhancing the learning experience. A research study investigating both groups of students and the teaching team would give the opportunity to see how peer interaction changes over time and the influence of peers on the student learning experience.

In relation to the uses of peer learning in an online environment, there are opportunities for future research as follows:

- To compare the difference between synchronous and asynchronous technologies with guidelines for the selection of the right technology with consideration for online undergraduate and postgraduate students.

- It can be seen that the teaching team has a number of roles and responsibilities in supporting student learning. Future research could examine how the teaching team or educational staff is able to enhance professional abilities for supporting peer learning activities according to the learning objectives of online courses.

- That said, the frequency of interaction is not an indicator for developing the student learning experience, since the quality of their communication is more important. Therefore, future research could examine how to create or improve the quality of messages in communication with each other. There may be essential elements or rules that students should follow in order to carry out effective interaction for enhancing their learning experience.

These can be the ways of increasing the potential of online teaching and learning, while at the same time reducing the isolation and the drop out rate of students over the semester in order to increase online enrolment.

8.6 Chapter Summary

This final chapter provided some concluding comments in regard to the research that was undertaken. It provided an overview of the key findings from the research and significant contributions have been made at the substantive, methodological and theoretical levels. The limitations have also identified and more research could be undertaken in order to build upon and expand upon the topic that has already been investigated and determined in this research. Further research should consequently study asynchronous and synchronous technologies, the professional abilities of the teaching team, and the quality of messages for communication.

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Appendix A: Statements of anonymous online surveys

Adapted from The Constructivist On-Line Learning Environment Survey (COLLES)

No.	Statement
	Relevance
1	My learning focuses on issues that interest me
2	What I learn is important for my professional practice
3	I learn how to improve my professional practice
4	What I learn connects well with my professional practice
	Reflection
5	I think critically about how I learn
6	I think critically about my own ideas
7	I think critically about other students' ideas
8	I think critically about ideas in the readings
9	I think critically about how I actively share my own ideas/experiences
10	I think critically about how I actively engage with other students ideas/experiences
11	I think critically about how being active and engaging with other students has improved my learning experience
	Interaction
12	I explain my ideas to other students
13	I ask other students to explain their ideas
14	Other students ask me to explain my ideas
15	Other students respond to my ideas
16	I feel accountable in how I interact with other students
	Teacher support
17	The teacher stimulates my thinking
18	The teacher encourages me to participate
19	The teacher models good discourse
20	The teacher models critical self-reflection
	Peer support
21	Other students encourage my participation
22	Other students praise my contribution
23	Other students value my contribution
24	Other students empathise with my struggle to learn

Making Sense	
25	I make good sense of other students' messages
26	Other students make good sense of my messages
27	I make good sense of the teacher's messages
28	The teacher makes good sense of my messages
Course Technology	
29	The course technology encourages my participation
30	The course technology supports my learning
31	The course technology improves my learning experience
32	The course technology enhances the learning activities

Appendix B: Learning Experience Survey One

Adapted from The Constructivist On-Line Learning Environment Survey (COLLES)

Introduction

This learning experience questionnaire is adapted from The Constructivist On-Line Learning Environment Survey (COLLES). There are seven parts of this questionnaire: relevance, reflection, interaction, teacher support, peer support, making sense, and course technology.

Directions

The purpose of this questionnaire is to help us understand how well the online delivery of this unit enabled you to learn.

Each one of the 35 statements below asks about your experience in this unit.

There are no 'right' or 'wrong' answers; we are interested only in your opinion. Please be assured that your responses will be treated with a high degree of confidentiality, and will not affect your assessment.

Your carefully considered responses will help us improve the way this unit is presented online in the future.

Background Information

What is your age?
□ 18-21 □ 22-25 □ 26-30 □ 31-35 □ 36-40 □ 41-50 □ 51-60 □ 61+

Gender: □ Male □ Female

How are you enrolled in this unit?
□ Off campus □ On campus

Relevance

In this unit …	Almost Always	Often	Sometimes	Seldom	Almost Never
1) My learning focuses on issues that interest me	□	□	□	□	□
2) What I learn is important for my professional practice	□	□	□	□	□
3) I learn how to improve my professional practice	□	□	□	□	□
4) What I learn connects well with my professional practice	□	□	□	□	□

Reflection

In this unit …	Almost Always	Often	Sometimes	Seldom	Almost Never
5) I think critically about how I learn	□	□	□	□	□
6) I think critically about my own ideas	□	□	□	□	□
7) I think critically about other students' ideas	□	□	□	□	□
8) I think critically about ideas in the readings	□	□	□	□	□
9) I think critically about I actively share my own ideas/experiences	□	□	□	□	□
10) I think critically about I actively engage with other students ideas/experiences	□	□	□	□	□
11) I think critically about how being active and engaging with other students have improved my learning experience	□	□	□	□	□

Interaction

In this unit …	Almost Always	Often	Sometimes	Seldom	Almost Never
12) I explain my ideas to other students	□	□	□	□	□
13) I ask other students to explain their ideas	□	□	□	□	□
14) Other students ask me to explain my ideas	□	□	□	□	□
15) Other students respond to my ideas	□	□	□	□	□
16) I feel accountable in how I interact with other students	□	□	□	□	□

Teacher support

In this unit …	Almost Always	Often	Sometimes	Seldom	Almost Never
17) The teacher stimulates my thinking	□	□	□	□	□
18) The teacher encourages me to participate	□	□	□	□	□
19) The teacher models good discourse	□	□	□	□	□
20) The teacher models critical self-reflection	□	□	□	□	□

Peer support

In this unit …	Almost Always	Often	Sometimes	Seldom	Almost Never
21) Other students encourage my participation	□	□	□	□	□
22) Other students praise my contribution	□	□	□	□	□
23) Other students value my contribution	□	□	□	□	□
24) Other students empathise with my struggle to learn	□	□	□	□	□

Making Sense

In this unit …	Almost Always	Often	Sometimes	Seldom	Almost Never
25) I make good sense of other students' messages	□	□	□	□	□
26) Other students make good sense of my messages	□	□	□	□	□
27) I make good sense of the teacher's messages	□	□	□	□	□
28) The teacher makes good sense of my messages	□	□	□	□	□

Course Technology

In this unit …	Almost Always	Often	Sometimes	Seldom	Almost Never
29) The course technology encourages my participation	□	□	□	□	□
30) The course technology supports my learning	□	□	□	□	□
31) The course technology improves my learning experience	□	□	□	□	□
32) The course technology enhances the learning activities	□	□	□	□	□

33) Which technologies do you think could support your learning activities with other students in online environment?
□ Google □ Email □ Skype □ Blog □ Twitter □ Facebook
□ Instant messaging/Chat □ Learning Management System (MyLO)
□ Others …………………….

34) How long did this survey take you to complete? (unit: minutes)
□ 5-10 □ 11-15 □ 16-20 □ 21+

35) Do you have any other comments?
………………………………………………………………………………

Appendix C: Learning Experience Survey Two

UTAS

Adapted from The Constructivist On-Line Learning Environment Survey (COLLES)

Introduction

This learning experience questionnaire is adapted from The Constructivist On-Line Learning Environment Survey (COLLES). There are seven parts of this questionnaire: relevance, reflection, interaction, teacher support, peer support, making sense, and course technology.

Directions

The purpose of this questionnaire is to help us understand how well the online delivery of this unit enabled you to learn.

Each one of the 35 statements below asks about your experience in this unit.

There are no 'right' or 'wrong' answers; we are interested only in your opinion. Please be assured that your responses will be treated with a high degree of confidentiality, and will not affect your assessment.

Your carefully considered responses will help us improve the way this unit is presented online in the future.

Background Information

What is your age?
□ 18-21 □ 22-25 □ 26-30 □ 31-35 □ 36-40 □ 41-50 □ 51-60 □ 61+

Gender: □ Male □ Female

How are you enrolled in this unit?
□ Off campus □ On campus

Relevance

In this unit …			Almost Always	Often	Sometimes	Seldom	Almost Never
1)	I prefer that	My learning focuses on issues that interest me	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
2)	I prefer that	What I learn is important for my professional practice	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
3)	I prefer that	I learn how to improve my professional practice	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
4)	I prefer that	What I learn connects well with my professional practice	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐

Reflection

In this unit …			Almost Always	Often	Sometimes	Seldom	Almost Never
5)	I prefer that	I think critically about how I learn	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
6)	I prefer that	I think critically about my own ideas	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
7)	I prefer that	I think critically about other students' ideas	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
8)	I prefer that	I think critically about ideas in the readings	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
9)	I prefer that	I think critically about I actively share my own ideas/ Experiences	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
10)	I prefer that	I think critically about I actively engage with other students ideas/ Experiences	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐

11)	I prefer that	I think critically about how being active and engaging with other students have improved my learning experience	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐

Interaction

In this unit …			Almost Always	Often	Sometimes	Seldom	Almost Never
12)	I prefer that	I explain my ideas to other students	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
13)	I prefer that	I ask other students to explain their ideas	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
14)	I prefer that	Other students ask me to explain my ideas	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
15)	I prefer that	Other students respond to my ideas	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐
16)	I prefer that	I feel accountable in how I interact with other students	☐	☐	☐	☐	☐
	I found that		☐	☐	☐	☐	☐

Teacher support

In this unit …			Almost Always	Often	Sometimes	Seldom	Almost Never
17)	I prefer that	The teacher stimulates my thinking	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
18)	I prefer that	The teacher encourages me to participate	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
19)	I prefer that	The teacher models good discourse	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
20)	I prefer that	The teacher models critical self-reflection	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻

Peer support

In this unit …			Almost Always	Often	Sometimes	Seldom	Almost Never
21)	I prefer that	Other students encourage my participation	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
22)	I prefer that	Other students praise my contribution	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
23)	I prefer that	Other students value my contribution	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
24)	I prefer that	Other students empathise with my struggle to learn	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻

Making Sense

In this unit …			Almost Always	Often	Sometimes	Seldom	Almost Never
25)	I prefer that	I make good sense of other students' messages	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
26)	I prefer that	Other students make good sense of my messages	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
27)	I prefer that	I make good sense of the teacher's messages	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻
28)	I prefer that	The teacher makes good sense of my messages	◻	◻	◻	◻	◻
	I found that		◻	◻	◻	◻	◻

Course Technology

In this unit …			Almost Always	Often	Sometimes	Seldom	Almost Never
29)	I prefer that	The course technology encourages my participation	□	□	□	□	□
	I found that		□	□	□	□	□
30)	I prefer that	The course technology supports my learning	□	□	□	□	□
	I found that		□	□	□	□	□
31)	I prefer that	The course technology improves my learning experience	□	□	□	□	□
	I found that		□	□	□	□	□
32)	I prefer that	The course technology enhances the learning activities	□	□	□	□	□
	I found that		□	□	□	□	□

33) Which technologies do you think could support your learning activities with other students in online environment?
□ Google □ Email □ Skype □ Blog □ Twitter □ Facebook
□ Instant messaging/Chat □ Learning Management System (MyLO)
□ Others …………………….

34) How long did this survey take you to complete? (unit: minutes)
□ 5-10 □ 11-15 □ 16-20 □ 21+

35) Do you have any other comments?
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………

Appendix D: Student Focus Group Interview Questions

The focus group participants will be asked open ended exploratory questions, and as such it is not possible to definitively list all the questions that might be asked in unpacking the major themes of the questions below. Any prompt questions will follow a common structure allowing the researcher to investigate deeper, any responses from the participants with the intention of only exploring the boundaries of the question being posed at the time.

The list below indicates range and type of issues that will be addressed during the focus group.

I would like to discuss with you your recent learning experiences within this unit, from your point of view,

1) **Relevance:** What aspects of this unit did you find most relevant to you and your future employment goals?
2) **Reflection:** How did the activities within this unit allow you to think more critically about your ideas and those of your peers?
3) **Interaction:** How do you feel about the way you were asked to interact with your peers in this unit?
4) **Teacher support:** What do you think about the way the teaching team encouraged you to participate with content and your peers in this unit?
5) **Peer support:** What do you think about how your peers interacted with you in this unit?
6) **Making sense (Interpretation):** What do you think about the way you were asked to communicate with the teaching team and your peers in this unit?
7) **Course Technology:** What do you think about the technology used within this unit to facilitate engagement with the content and your peers?
8) What was the most memorable aspect of this unit for you?
9) What was the least memorable aspect of this unit for you?
10) Is there anything else that you would like to add?

Appendix E: Staff Participant Interview Questions

The interviews will be open ended, and as such it is not possible to definitively list the questions asked. Any prompt questions will follow a common structure allowing the researcher to investigate deeper, any responses from the participants with the intention of only exploring the boundaries of the question being posed at the time.

From your point of view,

1) **Relevance**: What is the relevance of online learning (processes/activities) on students in online environment?
2) **Reflection:** What is the impact of online learning (processes/activities on students' critical reflective thinking in online environment?
3) **Interaction:** What is the nature of student interaction in online environment?
4) **Teacher support:** How do you support students' interaction both individually and peer group learning in online environment?
5) **Peer support:** How do students support one another in online environment?
6) **Making sense (Interpretation):**
   6.1 How about the effectiveness of teacher and students communicate with each other in online environment?
   6.2 How about the effectiveness of students and students communicate with each other in online environment?
7) **Course Technology:**
   7.1 What is the technology that you use to support students' participation in online learning?
   7.2 Would you like to have additional technologies? Why?
8) Is there anything else you would like to tell me?

Appendix F: Quantitative data analysis (stage one)

Discussion Board Analysis

Student no.	Threads	Replies	Read
1	14	66	474
2	6	14	380
3	7	13	346
4	4	19	232
5	5	7	146
6	8	13	424
7	8	4	63
8	7	15	205
9	11	10	161
10	19	26	4536
11	7	7	4030
12	4	2	21
13	9	9	100
14	19	89	4613
15	10	11	208
16	9	12	2407
17	8	2	82
18	6	6	105
19	20	31	195
20	6	3	43
21	5	3	197
22	6	4	284
23	18	13	511
24	15	9	202
25	0	0	0
26	4	12	832
27	16	30	166
28	15	95	1878
29	17	21	250
30	23	28	609
31	13	11	192
32	7	8	48
33	15	9	183
34	12	13	406
35	0	0	331
36	9	10	140
37	33	33	517
38	0	0	0
39	4	2	29

Student no.	Threads	Replies	Read
40	4	4	24
41	9	8	161
42	4	1	253
43	10	9	173
44	7	26	1716
45	8	13	119
46	4	5	32
47	12	25	349
48	5	5	543
49	5	1	42
50	9	14	159
51	3	1	77
52	10	15	124
53	3	2	656
54	10	12	3216
55	8	8	165
56	4	5	144
57	13	7	143
58	5	2	185
59	6	2	207
60	6	2	62
61	6	11	455
62	7	7	195
63	8	5	43
64	9	8	45
65	20	19	271
66	23	54	510
67	7	10	57
68	9	13	194
69	10	9	244
70	10	10	154
71	15	40	313
72	6	4	23
73	13	7	577
74	5	2	131
75	9	12	252
76	7	10	68
77	10	17	255
78	24	49	482
79	6	5	1047
80	5	6	133
81	12	15	116
82	9	27	671
83	10	28	285
84	10	21	187
85	8	5	230
86	13	15	144

Student no.	Threads	Replies	Read
87	7	4	52
88	3	0	38
89	6	7	36
90	5	3	182
91	6	1	44
92	4	0	33
93	5	2	59
94	7	6	37
95	7	7	4483
96	6	8	335
97	8	4	45
98	7	3	167
99	7	2	126
100	10	10	316
101	8	9	56
102	6	6	75
103	9	2	33
104	4	3	20
105	17	13	285
106	4	4	41
107	6	9	26
108	5	6	56
109	5	5	39
110	9	2	49
111	5	7	59
112	6	9	177
113	5	5	35
114	8	0	16
115	6	7	58
116	4	6	41
117	9	9	61
118	6	8	117
119	4	3	52
120	9	7	159
121	7	9	96
122	4	0	326
123	8	7	182
124	5	8	168
125	7	11	60
126	7	4	65
127	6	3	164
128	9	2	64
129	4	3	78
130	10	19	181
131	8	4	68
132	11	13	4474
133	14	21	430

Student no.	Threads	Replies	Read
134	6	6	411
135	5	7	132
136	15	46	401
137	8	7	184
138	14	15	136
139	6	5	87
140	6	8	67
141	21	54	490
142	13	29	208
143	8	21	156
144	15	8	1034
145	7	9	139
146	5	1	163
147	6	18	1041
148	13	15	229
149	3	0	83
150	3	5	156
151	19	23	333
152	5	4	129
153	8	5	34
154	15	28	310
155	5	9	53
156	8	17	561
157	12	33	642
158	24	47	231
159	8	4	86
160	9	12	321
161	9	11	50
162	18	25	2581
163	19	33	383
164	8	14	203
165	13	22	4613
166	13	27	285
167	6	5	64
168	4	0	81
169	12	31	417
170	7	17	130
171	11	13	268
172	10	8	507
173	13	26	289
174	2	0	77
175	10	20	2099
176	4	5	47
177	15	12	363
178	4	3	861
179	0	0	0
180	9	4	167

Student no.	Threads	Replies	Read
181	14	20	197
182	7	10	157
183	14	46	750
184	15	25	2571
185	19	45	310
186	16	71	1117
187	25	14	4613
188	6	1	127
189	5	2	206
190	17	17	4514
191	20	22	208
192	16	45	1317

Factory Analysis

1) First online survey

Step 1: Is the data suitable for factor analysis?

From 1st online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 26: 32 or 1:1.23, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		S1F1	S1F2	S1F3	S1F4	S1F5	S1F6	S1F7
S1F1	Pearson Correlation	1	.769**	.613**	.499**	.758**	.421*	.606**
	Sig. (2-tailed)		.000	.001	.010	.000	.032	.001
	N	26	26	26	26	26	26	26
S1F2	Pearson Correlation	.769**	1	.712**	.571**	.728**	.581**	.630**
	Sig. (2-tailed)	.000		.000	.002	.000	.002	.001
	N	26	26	26	26	26	26	26
S1F3	Pearson Correlation	.613**	.712**	1	.625**	.653**	.578**	.657**
	Sig. (2-tailed)	.001	.000		.001	.000	.002	.000
	N	26	26	26	26	26	26	26
S1F4	Pearson Correlation	.499**	.571**	.625**	1	.583**	.648**	.570**
	Sig. (2-tailed)	.010	.002	.001		.002	.000	.002
	N	26	26	26	26	26	26	26
S1F5	Pearson Correlation	.758**	.728**	.653**	.583**	1	.596**	.598**
	Sig. (2-tailed)	.000	.000	.000	.002		.001	.001
	N	26	26	26	26	26	26	26
S1F6	Pearson Correlation	.421*	.581**	.578**	.648**	.596**	1	.660**
	Sig. (2-tailed)	.032	.002	.002	.000	.001		.000
	N	26	26	26	26	26	26	26
S1F7	Pearson Correlation	.606**	.630**	.657**	.570**	.598**	.660**	1
	Sig. (2-tailed)	.001	.001	.000	.002	.001	.000	
	N	26	26	26	26	26	26	26

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser's criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	16.481	51.502	51.502	16.481	51.502
2	3.033	9.477	60.978	3.033	9.477
3	1.875	5.859	66.837	1.875	5.859
4	1.658	5.183	72.020	1.658	5.183
5	1.552	4.851	76.871	1.552	4.851
6	1.226	3.832	80.704	1.226	3.832
7	1.151	3.597	84.301	1.151	3.597
8	.889	2.777	87.078		
9	.686	2.144	89.222		
10	.628	1.964	91.185		
11	.561	1.752	92.937		
12	.417	1.304	94.242		
13	.364	1.137	95.379		
14	.318	.994	96.373		
15	.274	.857	97.230		
16	.213	.666	97.896		
17	.167	.520	98.417		
18	.134	.418	98.834		
19	.108	.336	99.170		
20	.076	.237	99.407		
21	.068	.212	99.619		
22	.055	.173	99.792		
23	.034	.108	99.900		
24	.019	.059	99.959		
25	.013	.041	100.000		
26	1.013E-013	1.041E-013	100.000		
27	1.004E-013	1.012E-013	100.000		
28	1.002E-013	1.007E-013	100.000		
29	-1.001E-013	-1.004E-013	100.000		
30	-1.004E-013	-1.012E-013	100.000		
31	-1.004E-013	-1.014E-013	100.000		
32	-1.011E-013	-1.035E-013	100.000		

Total Variance Explained

Component	Extraction Sums of Squared Loadings	Rotation Sums of Squared Loadings		
	Cumulative %	Total	% of Variance	Cumulative %
1	51.502	6.539	20.435	20.435
2	60.978	3.988	12.462	32.896
3	66.837	3.825	11.953	44.850
4	72.020	3.623	11.323	56.173
5	76.871	3.376	10.550	66.723
6	80.704	3.097	9.678	76.401
7	84.301	2.528	7.900	84.301
8				
9				
10				
11				
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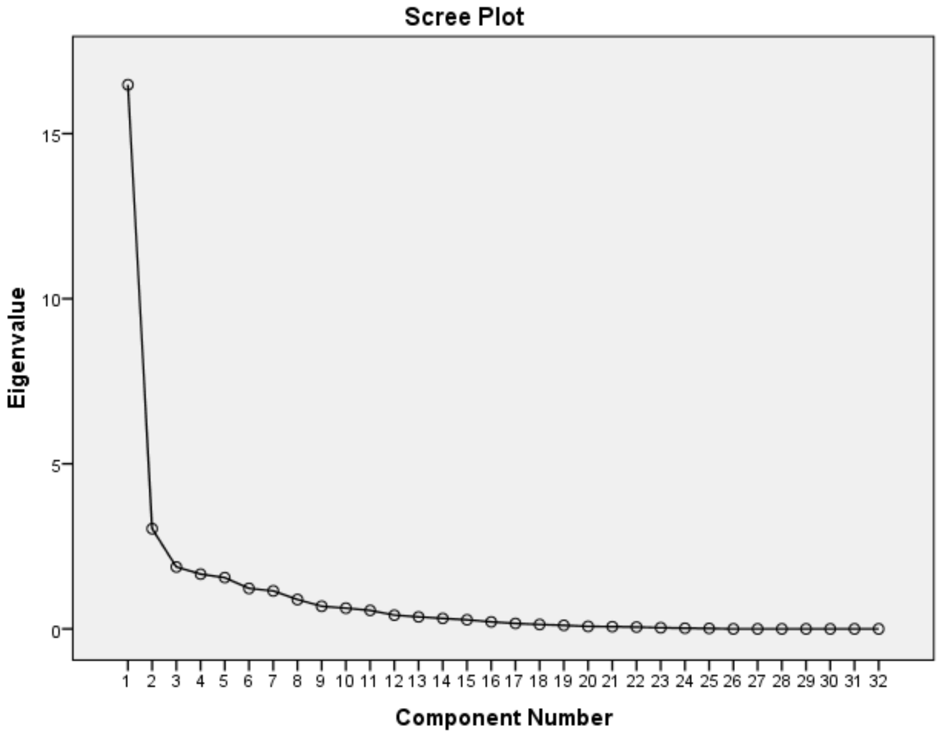
32				

Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
VAR00002	.835	-.094	.156	-.017	-.083	-.070	-.097
VAR00017	.825	-.179	-.002	-.255	-.209	-.171	-.184
VAR00004	.823	-.137	-.213	-.079	-.357	.023	-.083
VAR00003	.818	-.162	-.022	-.101	-.187	-.068	-.023
VAR00030	.815	-.402	-.064	-.007	.114	.010	-.122
VAR00029	.790	-.246	-.106	-.328	.052	.287	.016
VAR00011	.780	.139	-.231	-.302	.209	.339	.068
VAR00031	.767	-.501	-.114	.087	.102	.137	-.078
VAR00022	.763	.268	-.321	.154	-.113	-.038	-.185
VAR00032	.761	-.466	-.229	-.062	.182	.170	.062
VAR00013	.756	.278	-.132	.166	.228	-.030	.055
VAR00010	.744	.295	.250	-.287	.282	.025	.026
VAR00019	.740	-.190	.194	-.097	-.190	-.439	.147

VAR00008	.738	.296	.105	-.288	.225	-.051	.006
VAR00020	.735	.181	-.180	.051	-.198	-.391	-.164
VAR00023	.734	.013	-.437	.153	-.145	-.003	-.036
VAR00015	.732	.266	-.227	.143	.222	-.275	-.136
VAR00018	.727	-.228	.072	-.331	-.023	-.318	.276
VAR00005	.717	.340	.256	.044	-.299	.388	-.083
VAR00027	.708	-.530	.294	.056	.072	.116	-.086
VAR00001	.699	.114	.031	.110	-.081	.279	.398
VAR00021	.696	.109	-.507	-.070	-.175	.183	.238
VAR00026	.688	-.356	.247	.375	-.211	-.044	-.204
VAR00007	.662	.510	.058	-.022	-.079	-.068	-.072
VAR00012	.647	.231	.147	.393	.197	-.027	-.059
VAR00016	.639	.177	.307	.084	.279	-.206	.344
VAR00028	.638	-.544	.403	.035	.136	.036	-.055
VAR00024	.617	.237	.079	.016	-.222	-.092	.536
VAR00025	.611	.053	.349	.550	.033	.191	.152
VAR00014	.575	.059	-.366	.446	.456	-.075	-.055
VAR00009	.515	.446	.253	-.394	.358	.046	-.355
VAR00006	.512	.521	.286	.041	-.436	.189	-.220

Extraction Method: Principal Component Analysis.[a]

a. 7 components extracted.

Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
VAR00027	.905	.110	.088	.133	.096	.113	.137
VAR00028	.903	-.024	.043	.169	.085	.042	.188
VAR00031	.789	.404	.291	.052	.141	.003	.031
VAR00026	.750	-.028	.279	-.125	.281	.381	.096
VAR00030	.739	.341	.293	.191	.267	.010	.044
VAR00032	.698	.560	.246	.134	.114	-.130	.096
VAR00002	.557	.191	.219	.279	.389	.298	.196
VAR00003	.512	.364	.149	.180	.469	.221	.171
VAR00021	.084	.806	.275	.057	.265	.169	.213
VAR00011	.260	.697	.226	.541	.036	.128	.146
VAR00029	.576	.621	.025	.369	.149	.078	.086
VAR00023	.241	.551	.481	-.012	.370	.204	.050
VAR00004	.441	.538	.160	.057	.514	.321	.047
VAR00014	.226	.231	.869	.103	.003	-.082	.084
VAR00015	.134	.198	.688	.351	.380	.100	.117
VAR00013	.174	.301	.602	.344	.161	.189	.293
VAR00012	.280	-.014	.601	.237	.050	.339	.279

VAR00022	.127	.418	.560	.178	.390	.375	.014
VAR00009	.084	.015	.163	.915	.084	.244	-.055
VAR00010	.254	.181	.188	.749	.149	.203	.331
VAR00008	.190	.242	.232	.683	.254	.160	.271
VAR00020	.153	.194	.441	.175	.684	.255	.088
VAR00019	.483	.055	.081	.151	.663	.072	.413
VAR00017	.529	.310	.079	.292	.613	.198	.030
VAR00018	.454	.265	-.017	.295	.552	-.133	.431
VAR00006	-.002	.082	.062	.271	.219	.865	.101
VAR00005	.250	.298	.101	.303	.072	.799	.217
VAR00007	-.019	.177	.333	.438	.330	.472	.228
VAR00024	.055	.305	.106	.093	.315	.262	.710
VAR00016	.256	-.030	.329	.388	.146	.062	.656
VAR00001	.270	.469	.194	.113	.006	.340	.546
VAR00025	.453	-.022	.424	-.009	-.141	.477	.478

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 33 iterations.

2) Second online survey

Step 1: Is the data suitable for factor analysis?

From 2nd online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 24: 32 or 1:1.33, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		S2F1	S2F2	S2F3	S2F4	S2F5	S2F6
S2F1	Pearson Correlation	1	.125	.132	.265	.715**	-.002
	Sig. (2-tailed)		.562	.538	.211	.000	.994
	N	24	24	24	24	24	24
S2F2	Pearson Correlation	.125	1	.443*	.342	.391	.116
	Sig. (2-tailed)	.562		.030	.102	.059	.591
	N	24	24	24	24	24	24
S2F3	Pearson Correlation	.132	.443*	1	.423*	.561**	.127
	Sig. (2-tailed)	.538	.030		.039	.004	.555
	N	24	24	24	24	24	24
S2F4	Pearson Correlation	.265	.342	.423*	1	.471*	.162
	Sig. (2-tailed)	.211	.102	.039		.020	.451
	N	24	24	24	24	24	24
S2F5	Pearson Correlation	.715**	.391	.561**	.471*	1	.061
	Sig. (2-tailed)	.000	.059	.004	.020		.776
	N	24	24	24	24	24	24
S2F6	Pearson Correlation	-.002	.116	.127	.162	.061	1
	Sig. (2-tailed)	.994	.591	.555	.451	.776	
	N	24	24	24	24	24	24

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser's criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	12.097	37.802	37.802	12.097	37.802
2	7.506	23.455	61.257	7.506	23.455
3	3.104	9.701	70.958	3.104	9.701
4	2.039	6.373	77.331	2.039	6.373
5	1.606	5.019	82.350	1.606	5.019
6	1.427	4.459	86.809	1.427	4.459
7	.878	2.745	89.554		
8	.634	1.982	91.536		
9	.567	1.772	93.308		
10	.438	1.369	94.677		
11	.368	1.149	95.826		
12	.294	.917	96.744		
13	.278	.868	97.612		
14	.197	.617	98.229		
15	.175	.546	98.775		
16	.129	.402	99.177		
17	.101	.315	99.492		
18	.081	.252	99.744		
19	.034	.106	99.850		
20	.031	.097	99.946		
21	.017	.054	100.000		
22	1.007E-013	1.020E-013	100.000		
23	1.005E-013	1.016E-013	100.000		
24	1.004E-013	1.011E-013	100.000		
25	1.002E-013	1.007E-013	100.000		
26	1.001E-013	1.003E-013	100.000		
27	-1.000E-013	-1.001E-013	100.000		
28	-1.003E-013	-1.008E-013	100.000		
29	-1.004E-013	-1.012E-013	100.000		
30	-1.005E-013	-1.016E-013	100.000		
31	-1.010E-013	-1.032E-013	100.000		
32	-1.012E-013	-1.036E-013	100.000		

Total Variance Explained

Component	Extraction Sums of Squared Loadings	Rotation Sums of Squared Loadings		
	Cumulative %	Total	% of Variance	Cumulative %
1	37.802	11.066	34.583	34.583
2	61.257	5.734	17.920	52.503
3	70.958	4.565	14.266	66.769
4	77.331	2.911	9.096	75.865
5	82.350	1.873	5.852	81.718
6	86.809	1.629	5.092	86.809
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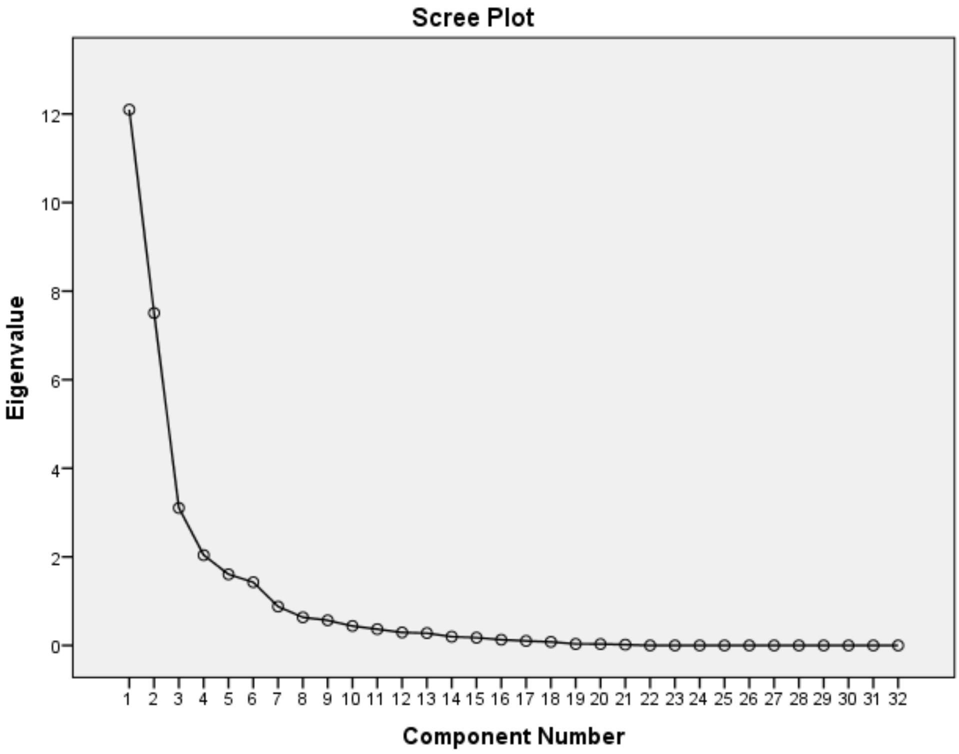
Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix[a]

	Component					
	1	2	3	4	5	6
VAR00010	.884	-.262	.079	-.061	.209	.188
VAR00008	.882	-.126	-.195	-.152	.186	-.128
VAR00016	.878	.192	-.091	-.053	-.067	-.195
VAR00012	.870	-.146	-.183	.023	-.073	.104
VAR00004	.865	-.292	-.203	-.168	.065	-.209
VAR00006	.862	-.285	-.041	.204	.064	-.125
VAR00009	.857	-.187	.226	-.173	.123	.128
VAR00005	.834	-.151	.053	.084	.159	-.190

VAR00007	.800	-.232	.212	.274	.107	-.215
VAR00003	.797	-.478	-.220	.024	.081	-.129
VAR00002	.749	-.373	-.446	.004	-.086	-.002
VAR00011	.745	-.355	.007	-.083	.126	.424
VAR00013	.719	-.300	.207	.024	-.371	.221
VAR00001	.708	-.431	-.181	-.315	-.120	-.193
VAR00014	.673	-.234	.258	-.147	-.374	.389
VAR00015	.666	-.427	.258	.164	-.092	.120
VAR00031	.384	.809	-.316	-.063	-.133	-.032
VAR00030	.360	.796	-.227	-.132	-.086	.065
VAR00028	.357	.750	-.391	.107	.044	.096
VAR00029	.295	.717	-.468	-.011	-.090	.335
VAR00024	.311	.703	.409	-.273	.111	.171
VAR00026	.359	.698	.118	-.262	.235	-.288
VAR00025	.395	.697	-.058	.092	.381	-.282
VAR00022	.342	.648	.428	-.335	-.005	-.019
VAR00027	.370	.642	-.436	.287	.039	.153
VAR00023	.309	.613	.505	-.449	.055	-.098
VAR00032	.195	.588	-.493	.030	-.311	.195
VAR00021	.295	.417	.623	-.198	-.304	.041
VAR00018	.325	.220	.496	.615	.080	.092
VAR00020	.424	.410	.421	.564	-.256	-.111
VAR00019	.380	.517	.107	.537	-.271	-.259
VAR00017	.052	.182	.135	.258	.735	.490

Extraction Method: Principal Component Analysis.[a]

a. 6 components extracted.

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
VAR00004	.955	.076	.038	-.075	-.095	-.134
VAR00003	.945	-.031	-.196	.000	-.033	-.047
VAR00008	.911	.192	.128	-.060	-.133	.020
VAR00010	.900	.004	.150	.039	.168	.275
VAR00006	.896	.029	-.066	.279	-.024	.024
VAR00002	.859	.218	-.295	-.089	.088	-.131
VAR00001	.851	-.057	.006	-.211	.053	-.309
VAR00012	.845	.270	-.004	.092	.185	.001
VAR00005	.835	.021	.130	.238	-.127	.050
VAR00009	.835	-.050	.332	.052	.197	.174
VAR00007	.799	-.124	.073	.449	-.082	.057
VAR00011	.789	.007	.012	-.085	.384	.326

VAR00016	.748	.380	.298	.198	-.081	-.154
VAR00015	.702	-.230	-.014	.291	.328	.068
VAR00013	.678	-.046	.086	.235	.547	-.115
VAR00029	.012	.947	.146	-.034	.093	.112
VAR00028	.074	.878	.189	.130	-.156	.116
VAR00031	.072	.864	.363	.105	-.129	-.118
VAR00027	.113	.860	.007	.225	-.113	.175
VAR00032	-.042	.851	.015	.011	.125	-.142
VAR00030	.047	.803	.435	.051	-.060	-.030
VAR00023	.040	.135	.956	.060	-.051	-.002
VAR00022	.043	.250	.866	.131	.015	.018
VAR00024	-.013	.321	.836	.119	.067	.232
VAR00021	.017	.025	.755	.317	.307	-.129
VAR00026	.121	.390	.706	.070	-.409	.019
VAR00020	.124	.198	.270	.887	.079	-.031
VAR00018	.112	-.007	.165	.791	.074	.351
VAR00019	.093	.420	.152	.775	-.114	-.175
VAR00014	.603	-.019	.219	.094	.681	-.049
VAR00025	.163	.515	.427	.255	-.550	.191
VAR00017	-.018	.079	.058	.071	-.082	.938

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 6 iterations.

Appendix G: Quantitative data analysis (stage two)

Factory Analysis

1) First online survey (unit one)

Step 1: Is the data suitable for factor analysis?

From 1st online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 36: 32 or 1:0.84, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		S1F1	S1F2	S1F3	S1F4	S1F5	S1F6
S1F1	Pearson Correlation	1	.332*	.408*	.527**	.464**	.570**
	Sig. (2-tailed)		.048	.014	.001	.004	.000
	N	36	36	36	36	36	36
S1F2	Pearson Correlation	.332*	1	.312	.463**	.430**	.317
	Sig. (2-tailed)	.048		.064	.004	.009	.060
	N	36	36	36	36	36	36
S1F3	Pearson Correlation	.408*	.312	1	.219	.521**	.631**
	Sig. (2-tailed)	.014	.064		.200	.001	.000
	N	36	36	36	36	36	36
S1F4	Pearson Correlation	.527**	.463**	.219	1	.270	.335*
	Sig. (2-tailed)	.001	.004	.200		.111	.046
	N	36	36	36	36	36	36
S1F5	Pearson Correlation	.464**	.430**	.521**	.270	1	.639**
	Sig. (2-tailed)	.004	.009	.001	.111		.000
	N	36	36	36	36	36	36
S1F6	Pearson Correlation	.570**	.317	.631**	.335*	.639**	1
	Sig. (2-tailed)	.000	.060	.000	.046	.000	
	N	36	36	36	36	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser’s criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	11.740	36.688	36.688	11.740	36.688	36.688	5.742
2	4.153	12.979	49.667	4.153	12.979	49.667	4.655
3	3.388	10.587	60.254	3.388	10.587	60.254	4.306
4	2.335	7.298	67.552	2.335	7.298	67.552	4.051
5	1.912	5.976	73.528	1.912	5.976	73.528	3.278
6	1.193	3.728	77.255	1.193	3.728	77.255	2.690
7	.988	3.086	80.342				
8	.924	2.886	83.228				
9	.815	2.548	85.776				
10	.690	2.157	87.933				
11	.593	1.854	89.786				
12	.574	1.794	91.580				
13	.430	1.344	92.924				
14	.389	1.217	94.141				
15	.361	1.128	95.270				
16							
		.965	96.235				
17	.278	.869	97.104				
18	.179	.560	97.664				
19	.168	.524	98.188				
20	.148	.463	98.650				
21	.093	.290	98.941				
22	.089	.279	99.220				
23	.072	.225	99.445				
24	.052	.162	99.607				
25	.046	.143	99.750				
26	.027	.085	99.835				
27	.022	.070	99.905				
28	.019	.058	99.963				
29	.006	.018	99.981				
30	.004	.011	99.992				
31	.001	.004	99.997				
32	.001	.003	100.000				

Total Variance Explained

Component	Rotation Sums of Squared Loadings	
	% of Variance	Cumulative %
1	17.942	17.942
2	14.548	32.490
3	13.457	45.947
4	12.659	58.606
5	10.244	68.851
6	8.405	77.255
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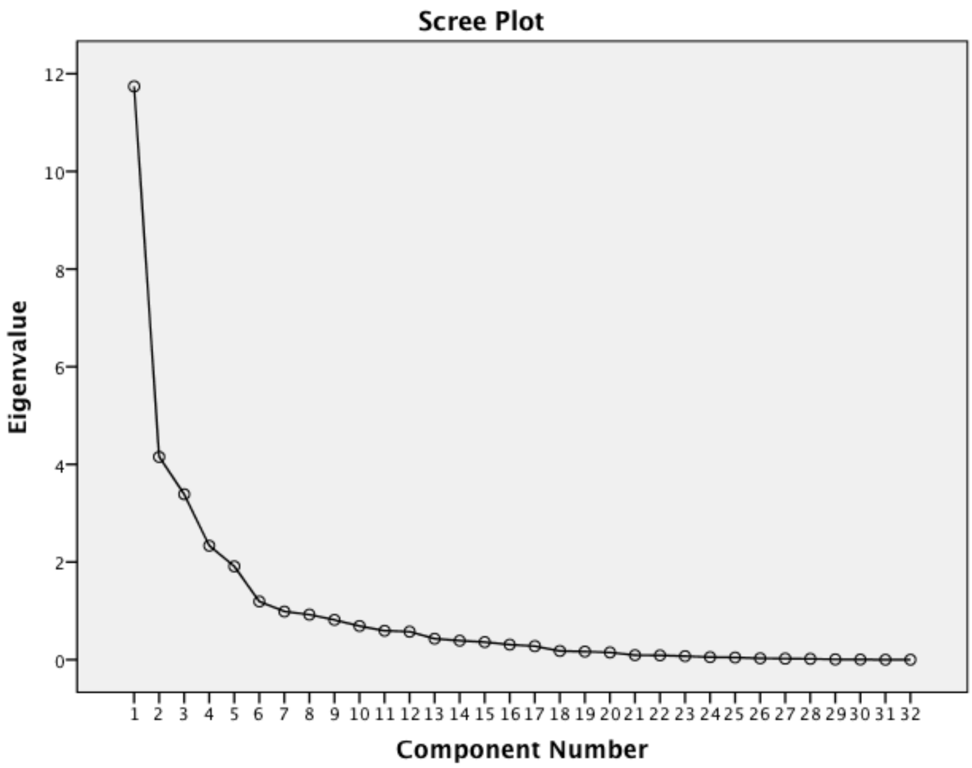
Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix[a]

	Component					
	1	2	3	4	5	6
VAR00010	.785					
VAR00008	.739		-.474			
VAR00006	.731		-.528			
VAR00011	.721					
VAR00005	.704		-.476			
VAR00009	.702		-.426			
VAR00032	.684	-.364		.502		
VAR00004	.683					.474
VAR00012	.671					
VAR00019	.667	-.487				-.301
VAR00018	.663	-.522				

VAR00003	.651					.504
VAR00014	.643		.425			
VAR00029	.631	-.385	.319	.481		
VAR00026	.615	.608			.305	
VAR00025	.608	.584				
VAR00017	.604	-.587				
VAR00030	.594	-.357		.531	-.324	
VAR00031	.589	-.365		.529		
VAR00013	.560	.363			-.437	
VAR00002	.551				.400	
VAR00016	.547	.309		.353		
VAR00028	.525	.391		.312	.475	
VAR00001	.524	-.411		-.369		
VAR00015	.484	.564				
VAR00027	.488	.489				.325
VAR00023	.474	.475	.426			
VAR00024	.413	.447	.376			
VAR00022	.397	.369	.705			
VAR00021	.530		.569	-.402		
VAR00007	.438		-.537		-.455	
VAR00020	.501				.560	-.326

Extraction Method: Principal Component Analysis.[a]

a. 6 components extracted.

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
VAR00006	.861					
VAR00005	.805					
VAR00010	.789	.328				
VAR00007	.787					
VAR00009	.776					
VAR00008	.751			.364		
VAR00011	.683					
VAR00016	.487		.350	.446		
VAR00022		.868				
VAR00023		.807				
VAR00021		.756			.362	
VAR00015		.710		.337		
VAR00014		.694				
VAR00013	.397	.682				
VAR00024		.569		.422		
VAR00030			.914			
VAR00031			.902			

VAR00032			.899			
VAR00029			.823			.353
VAR00017	.377		.486		.461	.301
VAR00027				.823		
VAR00028				.804		
VAR00026		.366		.791		
VAR00025	.319			.789		
VAR00003					.802	
VAR00004					.784	
VAR00002					.717	.317
VAR00001					.547	.538
VAR00020				.304		.764
VAR00019	.352		.413			.666
VAR00018	.330		.346		.484	.525
VAR00012	.309	.300		.428		.463

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 8 iterations.

2) Second online survey (unit one)

Step 1: Is the data suitable for factor analysis?

From 1st online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 12:32 or 1:2.67, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		S2F1	S2F2	S2F3	S2F4	S2F5	S2F6
S2F1	Pearson Correlation	1	.606*	.568	.575	.567	.710**
	Sig. (2-tailed)		.037	.054	.050	.054	.010
	N	12	12	12	12	12	12
S2F2	Pearson Correlation	.606*	1	.548	.748**	.549	.598*
	Sig. (2-tailed)	.037		.065	.005	.065	.040
	N	12	12	12	12	12	12
S2F3	Pearson Correlation	.568	.548	1	.357	.731**	.474
	Sig. (2-tailed)	.054	.065		.255	.007	.120
	N	12	12	12	12	12	12
S2F4	Pearson Correlation	.575	.748**	.357	1	.325	.351
	Sig. (2-tailed)	.050	.005	.255		.302	.263
	N	12	12	12	12	12	12
S2F5	Pearson Correlation	.567	.549	.731**	.325	1	.555
	Sig. (2-tailed)	.054	.065	.007	.302		.061
	N	12	12	12	12	12	12
S2F6	Pearson Correlation	.710**	.598*	.474	.351	.555	1
	Sig. (2-tailed)	.010	.040	.120	.263	.061	
	N	12	12	12	12	12	12

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser's criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	16.848	52.649	52.649	16.848	52.649	52.649	9.225
2	4.426	13.830	66.480	4.426	13.830	66.480	6.177
3	3.438	10.744	77.223	3.438	10.744	77.223	5.667
4	1.892	5.914	83.137	1.892	5.914	83.137	5.013
5	1.535	4.797	87.934	1.535	4.797	87.934	1.711
6	1.345	4.204	92.138	1.345	4.204	92.138	1.691
7	.946	2.956	95.093				
8	.683	2.135	97.228				
9	.464	1.450	98.679				
10	.266	.831	99.509				
11	.157	.491	100.000				
12	3.251E-15	1.016E-14	100.000				
13	8.985E-16	2.808E-15	100.000				
14	7.246E-16	2.264E-15	100.000				
15	6.092E-16	1.904E-15	100.000				
16	4.001E-16	1.250E-15	100.000				
17	3.189E-16	9.967E-16	100.000				
18	1.265E-16	3.952E-16	100.000				
19	8.574E-17	2.679E-16	100.000				
20	5.402E-17	1.688E-16	100.000				
21	6.771E-18	2.116E-17	100.000				
22	-5.992E-17	-1.872E-16	100.000				
23	-1.042E-16	-3.256E-16	100.000				
24	-1.623E-16	-5.070E-16	100.000				
25	-2.948E-16	-9.212E-16	100.000				
26	-3.789E-16	-1.184E-15	100.000				
27	-4.364E-16	-1.364E-15	100.000				
28	-4.843E-16	-1.513E-15	100.000				
29	-6.302E-16	-1.969E-15	100.000				
30	-7.969E-16	-2.490E-15	100.000				
31	-1.114E-15	-3.480E-15	100.000				
32	-1.266E-15	-3.955E-15	100.000				

Total Variance Explained

Component	Rotation Sums of Squared Loadings	
	% of Variance	Cumulative %
1	28.827	28.827
2	19.304	48.130
3	17.709	65.839
4	15.664	81.504
5	5.348	86.852
6	5.286	92.138
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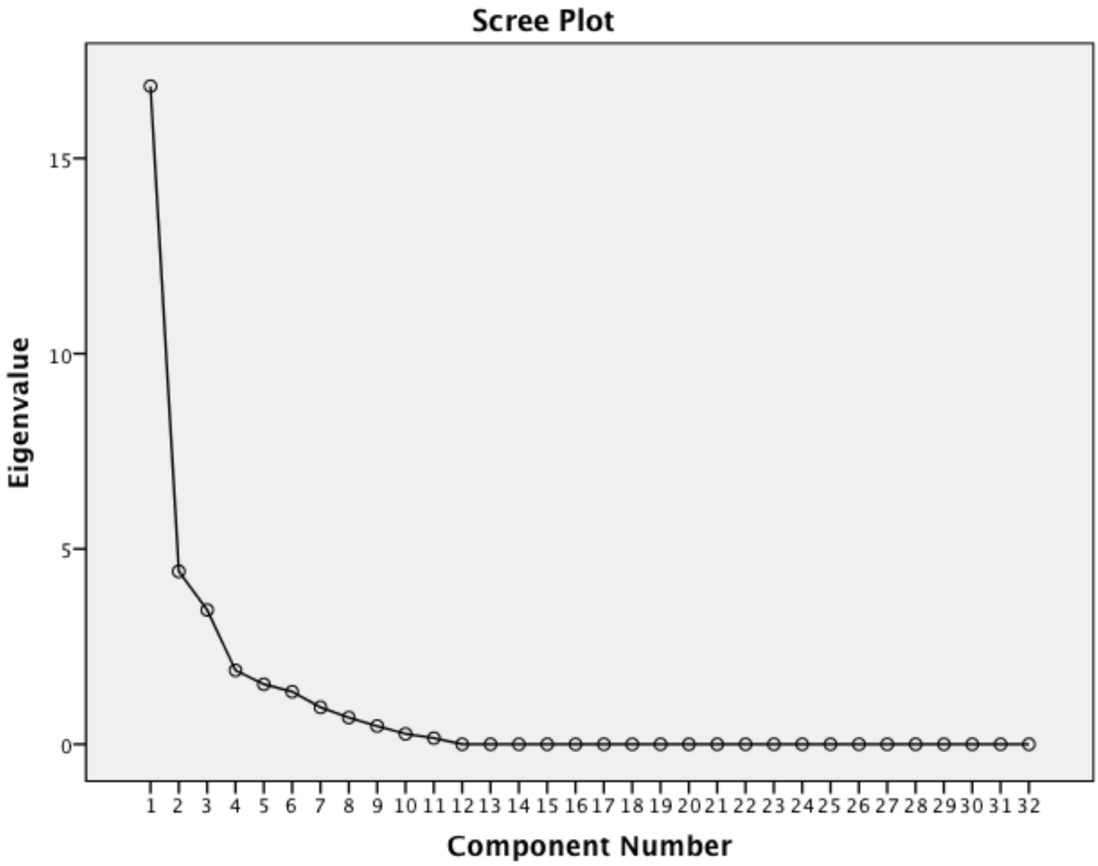
Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix[a]

	Component					
	1	2	3	4	5	6
VAR00009	.933					
VAR00028	.917			.336		
VAR00012	.903					
VAR00029	.868					
VAR00032	.833	-.316	-.379			
VAR00030	.813		-.358			
VAR00015	.806	.450				
VAR00016	.804	.392				
VAR00031	.794		-.454			
VAR00004	.783		-.470			

VAR00006	.759				-.403	
VAR00014	.755	.453				
VAR00003	.743	-.497				
VAR00025	.731	-.625				
VAR00026	.727	-.500	.378			
VAR00001	.723				-.412	.390
VAR00008	.719			-.419		.395
VAR00017	.719			.514		
VAR00010	.714			-.313		-.453
VAR00013	.689	.368		-.301		
VAR00027	.686	-.527		.326		
VAR00023	.673		.523			
VAR00019	.670	.606		.343		
VAR00011	.658	.576				
VAR00018	.650	.309	-.397	.493		
VAR00002	.647	-.583	-.351			
VAR00007	.632	-.491	.506			
VAR00020	.489	.733				
VAR00021	.612		.711			
VAR00024	.542		.704			.388
VAR00022	.503				.715	
VAR00005	.402				-.657	

Extraction Method: Principal Component Analysis.[a]

a. 6 components extracted.

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
VAR00002	.923					
VAR00032	.915					
VAR00030	.875	.394				
VAR00031	.872			.359		
VAR00027	.846		.312			
VAR00004	.843	.329				.311
VAR00025	.776		.567			
VAR00029	.653	.415		.389		
VAR00009	.645	.560		.353		
VAR00028	.639		.512	.481		
VAR00001	.498			.421	.393	.475
VAR00011		.856		.320		
VAR00014		.832		.324		
VAR00010		.816	.355			

VAR00013		.810				
VAR00016	.398	.761		.380		
VAR00015		.643		.534		
VAR00012	.536	.591				.328
VAR00021			.887			
VAR00024			.879			.355
VAR00007	.466		.767			
VAR00023			.747	.497		
VAR00026	.601		.731			
VAR00003	.655		.674			
VAR00019		.420		.864		
VAR00018	.407			.859		
VAR00020		.532		.762		
VAR00017		.304	.507	.646		-.365
VAR00006	.366			.644	.447	
VAR00005		.319			.731	
VAR00022	.357		.506		-.709	
VAR00008	.570	.348				.630

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 10 iterations.

3) First online survey (unit two)

Step 1: Is the data suitable for factor analysis?

From 1st online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 25:32 or 1:1.28, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		S1F1	S1F2	S1F3	S1F4	S1F5	S1F6	S1F7	S1F8
S1F1	Pearson Correlation	1	.255	.457*	.383	.059	.273	.471*	.200
	Sig. (2-tailed)		.218	.022	.059	.780	.186	.018	.337
	N	25	25	25	25	25	25	25	25
S1F2	Pearson Correlation	.255	1	.253	.581**	.539**	.292	.212	-.101
	Sig. (2-tailed)	.218		.223	.002	.005	.157	.309	.632
	N	25	25	25	25	25	25	25	25
S1F3	Pearson Correlation	.457*	.253	1	.388	.352	.622**	.444*	.182
	Sig. (2-tailed)	.022	.223		.055	.085	.001	.026	.383
	N	25	25	25	25	25	25	25	25
S1F4	Pearson Correlation	.383	.581**	.388	1	.518**	.216	.149	-.190
	Sig. (2-tailed)	.059	.002	.055		.008	.301	.476	.364
	N	25	25	25	25	25	25	25	25
S1F5	Pearson Correlation	.059	.539**	.352	.518**	1	.469*	.060	.242
	Sig. (2-tailed)	.780	.005	.085	.008		.018	.777	.244
	N	25	25	25	25	25	25	25	25
S1F6	Pearson Correlation	.273	.292	.622**	.216	.469*	1	.446*	.368
	Sig. (2-tailed)	.186	.157	.001	.301	.018		.026	.070
	N	25	25	25	25	25	25	25	25
S1F7	Pearson Correlation	.471*	.212	.444*	.149	.060	.446*	1	.117
	Sig. (2-tailed)	.018	.309	.026	.476	.777	.026		.577
	N	25	25	25	25	25	25	25	25
S1F8	Pearson Correlation	.200	-.101	.182	-.190	.242	.368	.117	1
	Sig. (2-tailed)	.337	.632	.383	.364	.244	.070	.577	
	N	25	25	25	25	25	25	25	25

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser's criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	10.532	32.913	32.913	10.532	32.913	32.913	7.188
2	5.517	17.239	50.153	5.517	17.239	50.153	4.981
3	3.543	11.071	61.224	3.543	11.071	61.224	3.187
4	1.958	6.117	67.341	1.958	6.117	67.341	2.703
5	1.867	5.834	73.175	1.867	5.834	73.175	2.572
6	1.520	4.751	77.925	1.520	4.751	77.925	2.537
7	1.267	3.961	81.886	1.267	3.961	81.886	2.340
8	1.057	3.303	85.189	1.057	3.303	85.189	1.752
9	.876	2.738	87.928				
10	.779	2.435	90.362				
11	.660	2.061	92.424				
12	.468	1.462	93.886				
13	.423	1.323	95.209				
14	.379	1.186	96.394				
15	.302	.945	97.339				
16	.213	.666	98.005				
17	.170	.532	98.536				
18	.132	.413	98.949				
19	.094	.294	99.244				
20	.074	.231	99.475				
21	.058	.180	99.656				
22	.053	.164	99.820				
23	.032	.100	99.920				
24	.025	.080	100.000				
25	7.483E-16	2.338E-15	100.000				
26	2.198E-16	6.869E-16	100.000				
27	4.299E-18	1.343E-17	100.000				
28	-1.869E-17	-5.841E-17	100.000				
29	-3.448E-16	-1.078E-15	100.000				
30	-4.948E-16	-1.546E-15	100.000				
31	-5.557E-16	-1.737E-15	100.000				
32	-9.649E-16	-3.015E-15	100.000				

Total Variance Explained

Component	Rotation Sums of Squared Loadings	
	% of Variance	Cumulative %
1	22.464	22.464
2	15.565	38.029
3	9.961	47.989
4	8.448	56.437
5	8.036	64.474
6	7.928	72.402
7	7.314	79.716
8	5.474	85.189
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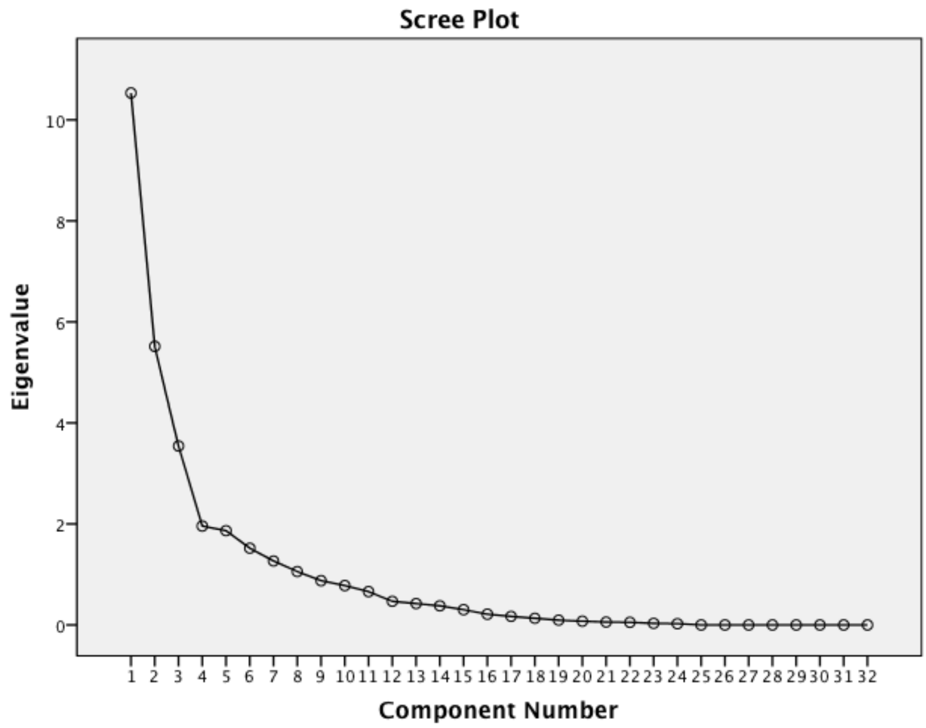
Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
VAR00012	.787		-.301	.302				
VAR00015	.731	-.435						
VAR00023	.714	-.512	-.319					
VAR00017	.705		.429					
VAR00013	.678	-.382						
VAR00010	.674		-.342					
VAR00011	.664	.486						
VAR00014	.654	-.527					.305	
VAR00022	.648	-.601	-.319					
VAR00025	.647	-.317		-.515				
VAR00016	.639					.321	-.417	
VAR00024	.636				.319	-.321		.319
VAR00021	.632	-.474						
VAR00004	.613		.415			-.578		
VAR00003	.596		.451			-.359		
VAR00009	.577		-.377	-.373				-.350
VAR00029	.561	.478		.437				
VAR00008	.535		.421			.306		.324
VAR00028	.498	-.326	.401		-.351	.329		
VAR00001	.403	.375		-.318		.325		-.346
VAR00006	.426	.742						

VAR00005		.710						
VAR00026	.561	-.668						
VAR00032	.490	.648						
VAR00030	.538	.647	-.314	.303				
VAR00031	.444	.592		.378				
VAR00019	.395		.758				-.324	
VAR00020	.565		.639					
VAR00007	.479	.487		-.508				
VAR00002			.480		.629			
VAR00027	.562				-.609			
VAR00018	.359		.507		.379		-.536	

Extraction Method: Principal Component Analysis.[a]

a. 8 components extracted.

Rotated Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
VAR00022	.952							
VAR00023	.906							
VAR00015	.841							
VAR00021	.831							
VAR00026	.801		.339					
VAR00014	.752						.436	
VAR00013	.710							-.306
VAR00024	.697						-.449	
VAR00012	.650	.591						
VAR00016	.586					.402		.334
VAR00032		.907						
VAR00030		.901		.313				
VAR00031		.856						
VAR00029		.846						
VAR00011		.630		.410				
VAR00004			.874					
VAR00003			.862					
VAR00020			.638			.563		
VAR00025	.525		.545					.425
VAR00001				.814				
VAR00009	.314			.737				
VAR00007				.598	.532			
VAR00010		.469		.513				.336
VAR00008					.797			
VAR00005		.436			.686			
VAR00006		.489		.372	.653			
VAR00018						.915		
VAR00019			.383			.785	.311	
VAR00017			.382		.420	.423	.357	

VAR00028	.332						.795	
VAR00027	.338						.744	
VAR00002						.319		-.763

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 9 iterations.

Appendix H: Quantitative data analysis (stage three)

Factor Analysis

1) First online survey (unit three)

Step 1: Is the data suitable for factor analysis?

From 1st online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 21:32 or 1:1.52, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		S1F1	S1F2	S1F3	S1F4	S1F5	S1F6	S1F7	S1F8
S1F1	Pearson Correlation	1	.521*	.547*	.524*	.324	.608**	.543*	.665**
	Sig. (2-tailed)		.015	.010	.015	.152	.003	.011	.001
	N	21	21	21	21	21	21	21	21
S1F2	Pearson Correlation	.521*	1	.174	.270	.190	.390	.742**	.433
	Sig. (2-tailed)	.015		.452	.236	.410	.080	.000	.050
	N	21	21	21	21	21	21	21	21
S1F3	Pearson Correlation	.547*	.174	1	.572**	.172	.305	.347	.599**
	Sig. (2-tailed)	.010	.452		.007	.456	.179	.123	.004
	N	21	21	21	21	21	21	21	21
S1F4	Pearson Correlation	.524*	.270	.572**	1	.340	.581**	.404	.536*
	Sig. (2-tailed)	.015	.236	.007		.132	.006	.070	.012
	N	21	21	21	21	21	21	21	21
S1F5	Pearson Correlation	.324	.190	.172	.340	1	.264	.003	.297
	Sig. (2-tailed)	.152	.410	.456	.132		.248	.991	.191
	N	21	21	21	21	21	21	21	21
S1F6	Pearson Correlation	.608**	.390	.305	.581**	.264	1	.494*	.383
	Sig. (2-tailed)	.003	.080	.179	.006	.248		.023	.086
	N	21	21	21	21	21	21	21	21
S1F7	Pearson Correlation	.543*	.742**	.347	.404	.003	.494*	1	.494*
	Sig. (2-tailed)	.011	.000	.123	.070	.991	.023		.023
	N	21	21	21	21	21	21	21	21
S1F8	Pearson Correlation	.665**	.433	.599**	.536*	.297	.383	.494*	1
	Sig. (2-tailed)	.001	.050	.004	.012	.191	.086	.023	
	N	21	21	21	21	21	21	21	21

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser's criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	13.332	41.662	41.662	13.332	41.662	41.662	7.131
2	3.866	12.082	53.744	3.866	12.082	53.744	4.928
3	2.849	8.902	62.646	2.849	8.902	62.646	4.371
4	2.552	7.977	70.623	2.552	7.977	70.623	3.297
5	2.393	7.478	78.101	2.393	7.478	78.101	3.216
6	1.290	4.031	82.131	1.290	4.031	82.131	3.011
7	1.185	3.703	85.835	1.185	3.703	85.835	1.280
8	1.039	3.246	89.081	1.039	3.246	89.081	1.272
9	.694	2.170	91.251				
10	.547	1.709	92.960				
11	.492	1.538	94.498				
12	.406	1.269	95.767				
13	.346	1.083	96.850				
14	.301	.942	97.791				
15	.261	.815	98.606				
16	.137	.429	99.035				
17	.122	.380	99.414				
18	.091	.283	99.698				
19	.052	.162	99.859				
20	.045	.141	100.000				
21	2.126E-15	6.644E-15	100.000				
22	5.284E-16	1.651E-15	100.000				
23	3.897E-16	1.218E-15	100.000				
24	2.126E-16	6.645E-16	100.000				
25	6.438E-17	2.012E-16	100.000				
26	-2.593E-17	-8.104E-17	100.000				
27	-9.760E-17	-3.050E-16	100.000				
28	-1.787E-16	-5.585E-16	100.000				
29	-3.548E-16	-1.109E-15	100.000				
30	-5.655E-16	-1.767E-15	100.000				
31	-8.410E-16	-2.628E-15	100.000				
32	-1.377E-15	-4.303E-15	100.000				

Total Variance Explained

	Rotation Sums of Squared Loadings	
Component	% of Variance	Cumulative %
1	22.283	22.283
2	15.400	37.683
3	13.660	51.343
4	10.302	61.645
5	10.052	71.697
6	9.409	81.105
7	3.999	85.105
8	3.976	89.081
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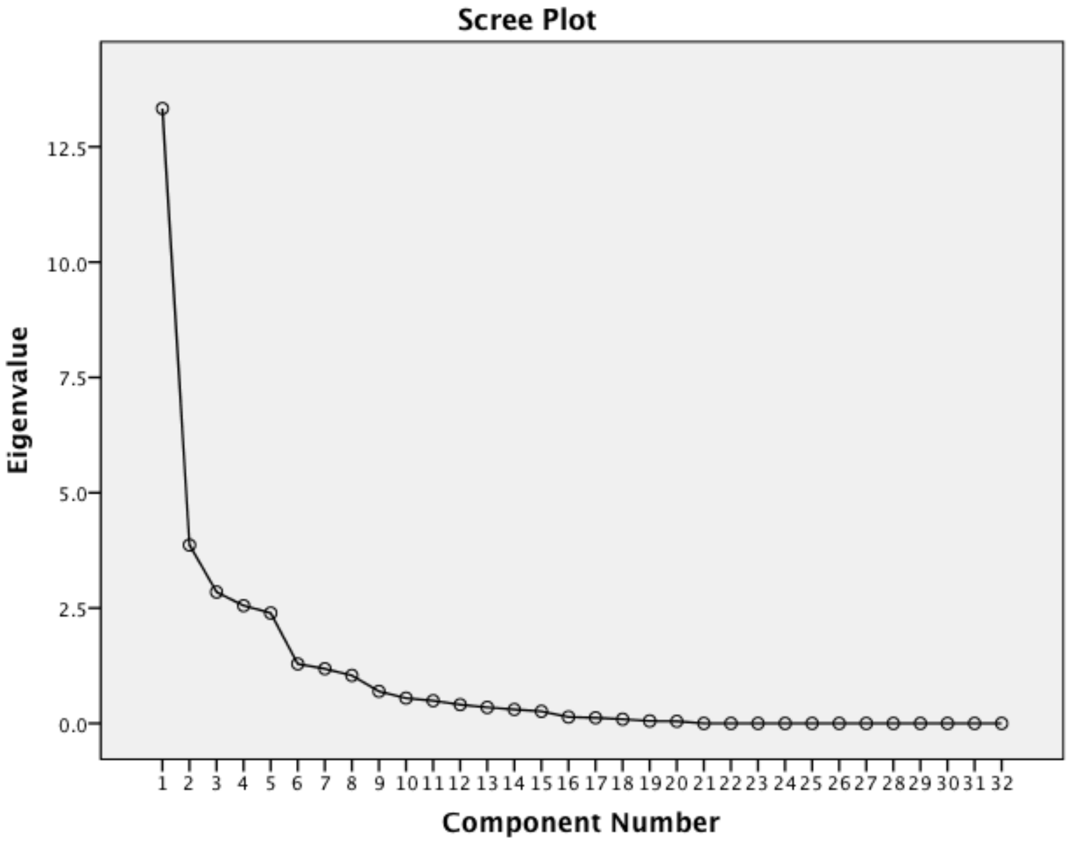
Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix

	Component							
	1	2	3	4	5	6	7	8
VAR00023	.922							
VAR00022	.852							
VAR00017	.839							
VAR00013	.811							
VAR00024	.768						.308	
VAR00014	.766						-.383	
VAR00031	.763	-.412			.322			
VAR00011	.763	.312						
VAR00027	.761			.416				
VAR00020	.760				-.391			
VAR00032	.758	-.394			.362			
VAR00016	.749						.413	
VAR00015	.739			-.538				
VAR00021	.703			-.545				

VAR00012	.694						-.404	-.356
VAR00019	.683	-.420						.328
VAR00005	.635	.593						
VAR00028	.635			.500				
VAR00026	.631				-.611			
VAR00018	.599	-.490				-.317		.353
VAR00008	.470	.442	.380		.392	-.330		
VAR00006	.430	.733						
VAR00009	.331	.634		.520				
VAR00007	.566	.615						
VAR00030	.492	-.589		.373	.322			
VAR00029	.455	-.517		.314	.355	.380		
VAR00002			.842					
VAR00004			.823					
VAR00003	.477		.664					
VAR00001	.490		.533			.531		
VAR00010	.335	.375		.524			.407	
VAR00025	.520				-.734	.329		

Extraction Method: Principal Component Analysis.[a]
a. 8 components extracted.

Rotated Component Matrix

	Component							
	1	2	3	4	5	6	7	8
VAR00015	.917							
VAR00021	.912							
VAR00023	.826			.317				
VAR00022	.798							
VAR00024	.770					.315		.331
VAR00020	.659			.571		.326		
VAR00014	.651						.313	-.383
VAR00013	.635	.472	.372					
VAR00017	.468		.323	.434	.418			
VAR00006		.891						
VAR00009		.827				.315		
VAR00008		.768			.402			
VAR00007	.317	.711						-.451
VAR00005	.454	.673						
VAR00011	.590	.597						
VAR00029			.922					
VAR00030			.895					
VAR00031	.472		.800					
VAR00032	.474		.782					
VAR00018			.320	.900				
VAR00019			.359	.838				
VAR00028		.342	.340	.519	.338	.432		
VAR00002					.880			
VAR00004					.867			
VAR00003				.339	.684			.455
VAR00001					.684	.400	-.341	
VAR00025						.924		
VAR00026	.454					.803		
VAR00027		.308	.476	.466		.495		
VAR00010		.606					-.611	
VAR00012	.418	.480				.304	.558	
VAR00016	.492	.307	.433					.551

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 9 iterations.

2) Second online survey (unit three)

Step 1: Is the data suitable for factor analysis?

From 2nd online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 11:32 or 1:2.9, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		VAR00001	VAR00002	VAR00003	VAR00004	VAR00005
VAR 00001	Pearson Correlation	1	.664*	.403	.685*	.622*
	Sig. (2-tailed)		.026	.220	.020	.041
	N	11	11	11	11	11
VAR 00002	Pearson Correlation	.664*	1	.498	.793**	.682*
	Sig. (2-tailed)	.026		.119	.004	.021
	N	11	11	11	11	11
VAR 00003	Pearson Correlation	.403	.498	1	.450	.174
	Sig. (2-tailed)	.220	.119		.165	.609
	N	11	11	11	11	11
VAR 00004	Pearson Correlation	.685*	.793**	.450	1	.664*
	Sig. (2-tailed)	.020	.004	.165		.026
	N	11	11	11	11	11
VAR 00005	Pearson Correlation	.622*	.682*	.174	.664*	1
	Sig. (2-tailed)	.041	.021	.609	.026	
	N	11	11	11	11	11

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser’s criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	18.731	58.533	58.533	18.731	58.533	58.533	10.389
2	5.010	15.655	74.188	5.010	15.655	74.188	9.643
3	2.686	8.394	82.582	2.686	8.394	82.582	3.410
4	1.911	5.971	88.553	1.911	5.971	88.553	3.240
5	1.360	4.251	92.804	1.360	4.251	92.804	3.015
6	.809	2.529	95.332				
7	.585	1.827	97.160				
8	.411	1.283	98.443				
9	.358	1.118	99.561				
10	.140	.439	100.000				
11	1.435E-15	4.483E-15	100.000				
12	1.005E-15	3.139E-15	100.000				
13	8.263E-16	2.582E-15	100.000				
14	6.556E-16	2.049E-15	100.000				
15	4.142E-16	1.294E-15	100.000				
16	2.468E-16	7.712E-16	100.000				
17	2.308E-16	7.213E-16	100.000				
18	2.217E-16	6.928E-16	100.000				
19	1.402E-16	4.381E-16	100.000				
20	1.257E-18	3.927E-18	100.000				
21	-8.123E-17	-2.538E-16	100.000				
22	-1.577E-16	-4.929E-16	100.000				
23	-2.227E-16	-6.959E-16	100.000				
24	-2.948E-16	-9.212E-16	100.000				
25	-3.933E-16	-1.229E-15	100.000				
26	-4.314E-16	-1.348E-15	100.000				
27	-6.668E-16	-2.084E-15	100.000				
28	-7.397E-16	-2.312E-15	100.000				
29	-1.005E-15	-3.140E-15	100.000				
30	-1.181E-15	-3.691E-15	100.000				
31	-1.456E-15	-4.551E-15	100.000				
32	-3.635E-15	-1.136E-14	100.000				

Total Variance Explained

Component	Rotation Sums of Squared Loadings	
	% of Variance	Cumulative %
1	32.465	32.465
2	30.135	62.600
3	10.656	73.256
4	10.125	83.381
5	9.423	92.804
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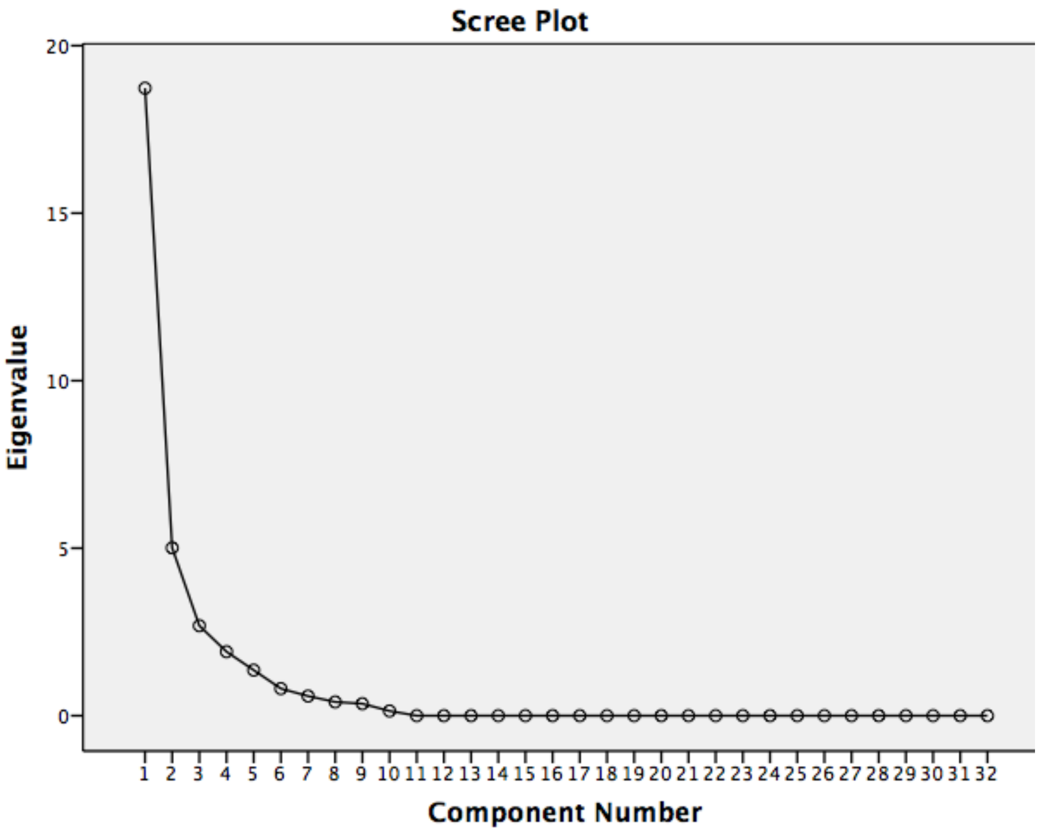
Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix[a]

	Component				
	1	2	3	4	5
VAR00023	.943				
VAR00021	.922				
VAR00012	.904				
VAR00032	.874			-.381	
VAR00010	.869				
VAR00009	.869				
VAR00013	.849				

VAR00029	.846	-.351			-.312
VAR00022	.841				
VAR00017	.841		-.434		
VAR00018	.835				
VAR00019	.833			-.434	
VAR00025	.830				
VAR00026	.816	-.318			-.348
VAR00031	.812	-.519			
VAR00020	.799	.324			.331
VAR00027	.799			-.389	.405
VAR00002	.798	-.562			
VAR00003	.798	-.562			
VAR00004	.798	-.562			
VAR00030	.769	-.461			
VAR00006	.760	.420		-.330	
VAR00011	.738	.370	-.406		
VAR00016	.624	.606			
VAR00001	.556		-.526	.415	.353
VAR00024	.670	.718			
VAR00028	.625	-.703			
VAR00005	.579	.650			
VAR00007	.414	.639	.509		
VAR00015	.462		.820		
VAR00008	.434	.537	.555		.318
VAR00014	.543		.425	.650	

Extraction Method: Principal Component Analysis.[a]
a. 5 components extracted.

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
VAR00029	.908	.361			
VAR00026	.889	.361			
VAR00028	.885				.368
VAR00031	.883			.381	
VAR00002	.875				.361
VAR00003	.875				.361
VAR00004	.875				.361
VAR00030	.832			.456	
VAR00032	.714	.354		.561	
VAR00025	.712	.492			
VAR00021	.656	.650	.305		
VAR00024		.928	.337		
VAR00005		.883			
VAR00011		.870			
VAR00016		.770		.388	
VAR00013	.401	.747			.408
VAR00010	.343	.742			.392
VAR00009	.343	.742			.392
VAR00012	.493	.733			
VAR00018	.400	.710	.460		
VAR00023	.557	.687			.367
VAR00006		.684		.486	
VAR00022	.622	.637			
VAR00008		.338	.828	.306	
VAR00014	.333		.820		.422
VAR00007		.446	.791		
VAR00015	.614		.747		
VAR00027	.450	.321		.768	
VAR00019	.373	.577		.692	
VAR00020		.609		.620	
VAR00001	.330				.901
VAR00017	.396	.556		.355	.606

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 8 iterations.

3) First online survey (unit two)

Step 1: Is the data suitable for factor analysis?

From 1st online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 62:32 or 1:0.52, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		S1F1	S1F2	S1F3	S1F4	S1F5	S1F6	S1F7	S1F8
S1F1	Pearson Correlation	1	.384**	.104	-.274*	.036	.307*	.445**	.288*
	Sig. (2-tailed)		.002	.419	.031	.779	.015	.000	.023
	N	62	62	62	62	62	62	62	62
S1F2	Pearson Correlation	.384**	1	.414**	-.053	.120	.255*	.341**	.324*
	Sig. (2-tailed)	.002		.001	.684	.354	.046	.007	.010
	N	62	62	62	62	62	62	62	62
S1F3	Pearson Correlation	.104	.414**	1	.231	-.210	.198	.185	.484**
	Sig. (2-tailed)	.419	.001		.071	.102	.123	.149	.000
	N	62	62	62	62	62	62	62	62
S1F4	Pearson Correlation	-.274*	-.053	.231	1	.273*	.265*	.058	.002
	Sig. (2-tailed)	.031	.684	.071		.031	.037	.656	.990
	N	62	62	62	62	62	62	62	62
S1F5	Pearson Correlation	.036	.120	-.210	.273*	1	.413**	.145	-.046
	Sig. (2-tailed)	.779	.354	.102	.031		.001	.260	.725
	N	62	62	62	62	62	62	62	62
S1F6	Pearson Correlation	.307*	.255*	.198	.265*	.413**	1	.327**	.231
	Sig. (2-tailed)	.015	.046	.123	.037	.001		.009	.071
	N	62	62	62	62	62	62	62	62
S1F7	Pearson Correlation	.445**	.341**	.185	.058	.145	.327**	1	.282*
	Sig. (2-tailed)	.000	.007	.149	.656	.260	.009		.026
	N	62	62	62	62	62	62	62	62
S1F8	Pearson Correlation	.288*	.324*	.484**	.002	-.046	.231	.282*	1
	Sig. (2-tailed)	.023	.010	.000	.990	.725	.071	.026	
	N	62	62	62	62	62	62	62	62

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser's criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.157	22.364	22.364	7.157	22.364	22.364	3.698
2	4.261	13.315	35.679	4.261	13.315	35.679	3.287
3	3.961	12.378	48.057	3.961	12.378	48.057	3.278
4	2.131	6.658	54.715	2.131	6.658	54.715	2.760
5	1.750	5.470	60.185	1.750	5.470	60.185	2.661
6	1.648	5.149	65.334	1.648	5.149	65.334	2.656
7	1.290	4.032	69.365	1.290	4.032	69.365	2.515
8	1.102	3.444	72.809	1.102	3.444	72.809	2.444
9	.991	3.096	75.905				
10	.972	3.039	78.943				
11	.785	2.454	81.398				
12	.746	2.332	83.730				
13	.666	2.081	85.811				
14	.561	1.755	87.565				
15	.524	1.639	89.204				
16	.433	1.352	90.555				
17	.413	1.290	91.845				
18	.405	1.265	93.111				
19	.335	1.047	94.158				
20	.291	.911	95.069				
21	.249	.779	95.848				
22	.215	.671	96.519				
23	.211	.659	97.178				
24	.188	.586	97.765				
25	.175	.546	98.311				
26	.125	.391	98.702				
27	.101	.315	99.017				
28	.088	.275	99.293				
29	.075	.233	99.526				
30	.064	.200	99.726				
31	.050	.155	99.881				
32	.038	.119	100.000				

Total Variance Explained

Component	Rotation Sums of Squared Loadings	
	% of Variance	Cumulative %
1	11.555	11.555
2	10.273	21.829
3	10.243	32.071
4	8.626	40.698
5	8.315	49.013
6	8.299	57.312
7	7.861	65.173
8	7.636	72.809
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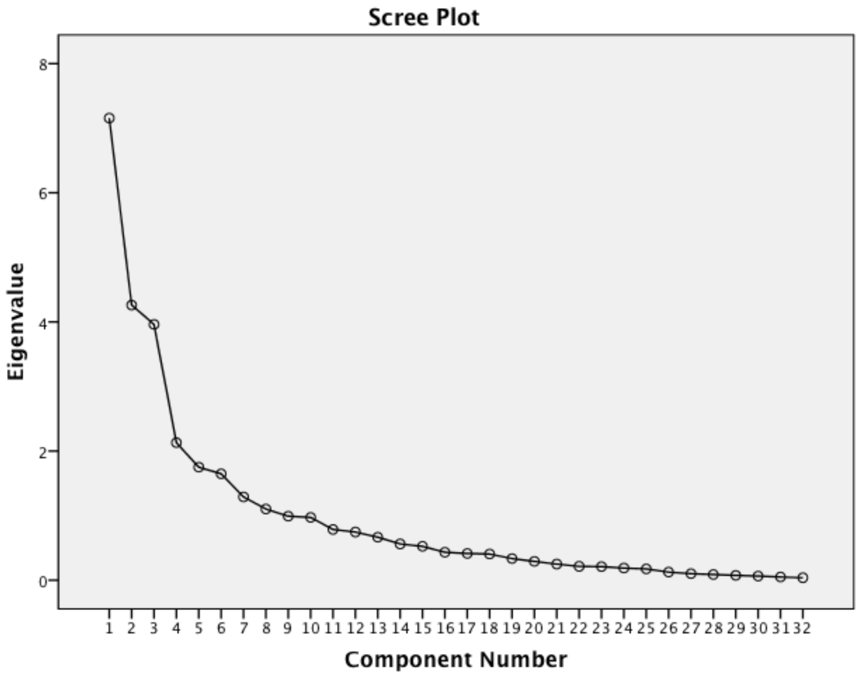
Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix

	Component							
	1	2	3	4	5	6	7	8
VAR00030	.699		-.342					
VAR00029	.657	-.310	-.321					
VAR00032	.640	-.357	-.361					
VAR00019	.636			.611				
VAR00020	.629			.594				
VAR00018	.622			.503				
VAR00017	.610			.449				
VAR00003	.607		-.321		.408			
VAR00031	.592	-.330	-.427					
VAR00021	.583		.569					
VAR00004	.575				.399		-.385	
VAR00016	.563							
VAR00028	.544					.437		
VAR00001	.441				.310			
VAR00014		.719						
VAR00012		.652						
VAR00010		.610			-.346			
VAR00015		.609	.484					
VAR00008		.603				.362		
VAR00009	.384	.599			-.380			
VAR00005		.595	-.451					
VAR00013		.580						
VAR00007		.537	-.385	.303		.306		.360
VAR00023	.425		.774					
VAR00022	.432		.704					

	1	2	3	4	5	6	7	8
VAR00006		.408	-.522					.405
VAR00024	.407		.485					.352
VAR00026	.438		.483			.459		
VAR00002	.411			-.306	.711			
VAR00027	.459					.507		
VAR00025	.453					.473	.301	
VAR00011	.492						-.494	

Extraction Method: Principal Component Analysis.[a]
a. 8 components extracted.

Rotated Component Matrix

	Component							
	1	2	3	4	5	6	7	8
VAR00032	.880							
VAR00031	.880							
VAR00029	.794							
VAR00030	.783							
VAR00020		.834						
VAR00019		.833						
VAR00018		.818						
VAR00017		.695						
VAR00022			.881					
VAR00023		.310	.777					
VAR00021			.701			.312		
VAR00024			.677					
VAR00014				.813				
VAR00015				.732				
VAR00012				.678				
VAR00013				.670				
VAR00007					.842			
VAR00006	.334				.718			
VAR00005					.709			
VAR00008					.691	.337		
VAR00009						.849		
VAR00010						.786		
VAR00011						.674	.307	
VAR00016	.335					.345		
VAR00002							.850	
VAR00004							.760	
VAR00003	.392						.698	
VAR00001		.308					.456	
VAR00025								.768
VAR00027								.732
VAR00026			.475					.674
VAR00028								.628

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.a
a. Rotation converged in 9 iterations.

4) Second online survey (unit two)

Step 1: Is the data suitable for factor analysis?

From 2nd online survey, although sample to variable (N:p, N refers to the number of participants and p refers to the number of variables) ratio is low as 28:32 or 1:1.14, the factorability of the correlation matrix was used in the EFA procedure showing the relationships between individual variables. With inspection the correlation matrix for correlation coefficients over 0.30 for approximately 30% data relationship or correlation of dependent variables. In addition, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to evaluate the appropriateness of the respondent data for factor analysis and KMO index was ranged from 0 to 1, with 0.50 considered appropriate for factor analysis.

Correlations

		VAR00001	VAR00002	VAR00003	VAR00004	VAR00005	VAR00006
VAR00001	Pearson Correlation	1	.279	.276	.737**	.354	.443*
	Sig. (2-tailed)		.151	.155	.000	.064	.018
	N	28	28	28	28	28	28
VAR00002	Pearson Correlation	.279	1	.519**	.571**	.515**	.383*
	Sig. (2-tailed)	.151		.005	.001	.005	.044
	N	28	28	28	28	28	28
VAR00003	Pearson Correlation	.276	.519**	1	.440*	.560**	.185
	Sig. (2-tailed)	.155	.005		.019	.002	.346
	N	28	28	28	28	28	28
VAR00004	Pearson Correlation	.737**	.571**	.440*	1	.577**	.483**
	Sig. (2-tailed)	.000	.001	.019		.001	.009
	N	28	28	28	28	28	28
VAR00005	Pearson Correlation	.354	.515**	.560**	.577**	1	.406*
	Sig. (2-tailed)	.064	.005	.002	.001		.032
	N	28	28	28	28	28	28
VAR00006	Pearson Correlation	.443*	.383*	.185	.483**	.406*	1
	Sig. (2-tailed)	.018	.044	.346	.009	.032	
	N	28	28	28	28	28	28
VAR00007	Pearson Correlation	.511**	.297	.258	.620**	.264	.525**
	Sig. (2-tailed)	.005	.124	.185	.000	.175	.004
	N	28	28	28	28	28	28

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Step 2: How will the factors be extracted?

Exploratory factor analysis (EFA) was conducted, with principal component analysis (PCA) as the method of factor extraction. The PCA explained the interrelationships between a group of factors. PCA is normally used in EFA (Thompson 2004). Also, PCA is used to establish preliminary solutions in EFA (Pett, Lackey & Sullivan 2003).

Step 3: What criteria will assist in determining factor extraction?

The purpose of the data extraction is reducing a large amount of items into factors. This research used extraction rules and various procedures including Kaiser's criteria (eigenvalue > 1 value), the Scree test, and the cumulative percent of variance extracted.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	12.785	39.954	39.954	12.785	39.954	39.954	5.934
2	4.916	15.364	55.317	4.916	15.364	55.317	5.784
3	2.581	8.064	63.382	2.581	8.064	63.382	3.599
4	2.149	6.714	70.096	2.149	6.714	70.096	3.520
5	1.991	6.222	76.318	1.991	6.222	76.318	3.201
6	1.401	4.379	80.697	1.401	4.379	80.697	3.074
7	1.039	3.246	83.943	1.039	3.246	83.943	1.750
8	.761	2.379	86.321				
9	.695	2.173	88.495				
10	.672	2.101	90.596				
11	.518	1.618	92.214				
12	.472	1.474	93.687				
13	.364	1.137	94.824				
14	.354	1.106	95.930				
15	.268	.838	96.768				
16	.234	.731	97.499				
17	.214	.670	98.169				
18	.150	.468	98.638				
19	.121	.377	99.014				

20	.083	.259	99.273				
21	.066	.207	99.481				
22	.060	.186	99.667				
23	.039	.123	99.790				
24	.028	.089	99.879				
25	.019	.059	99.937				
26	.014	.044	99.981				
27	.006	.019	100.000				
28	2.284E-15	7.139E-15	100.000				
29	5.575E-16	1.742E-15	100.000				
30	1.333E-16	4.165E-16	100.000				
31	-1.806E-16	-5.644E-16	100.000				
32	-5.259E-16	-1.643E-15	100.000				

Total Variance Explained

	Rotation Sums of Squared Loadings	
Component	% of Variance	Cumulative %
1	18.544	18.544
2	18.074	36.618
3	11.246	47.864
4	11.001	58.865
5	10.003	68.868
6	9.605	78.474
7	5.469	83.943
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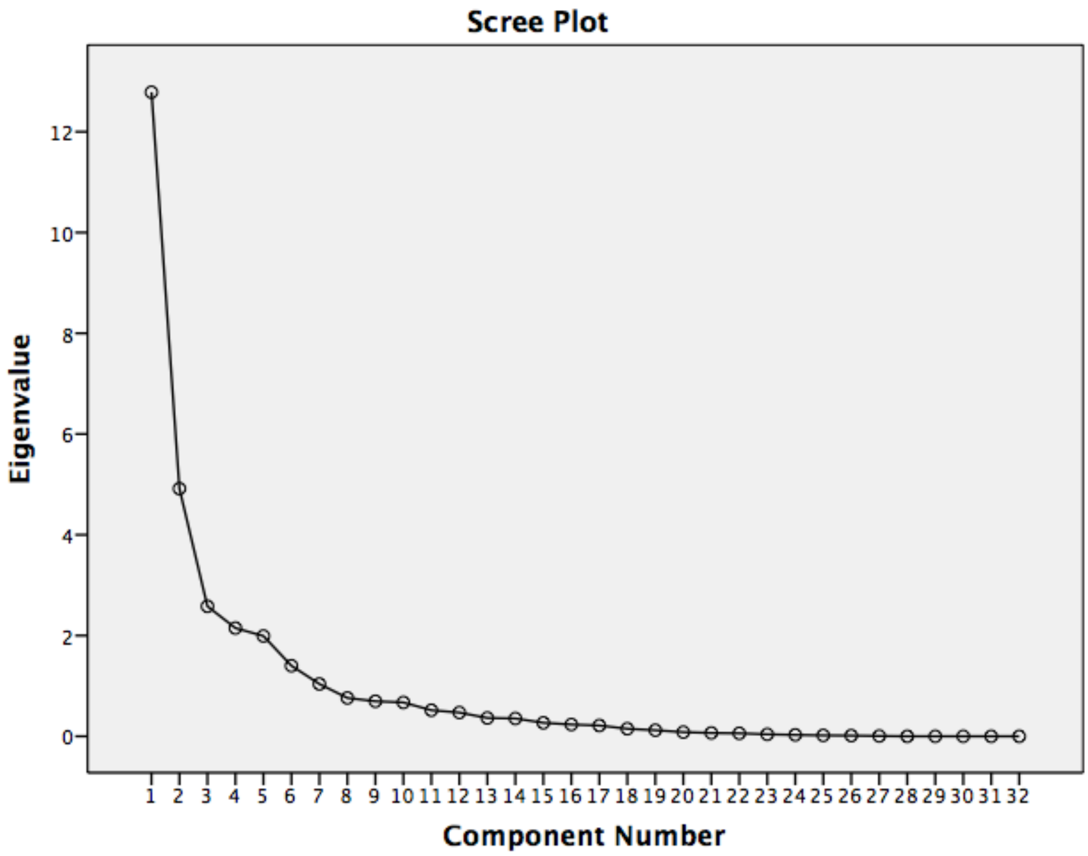
Extraction Method: Principal Component Analysis.



Step 4: Selection of rotational method

Rotation maximizes the high item loadings and minimizes low item loading. This research uses orthogonal varimax rotational technique for producing uncorrelated factor structures. The rotation will produce the best fit and factorial appropriateness (Kieffer 1999; Pett, Lackey & Sullivan 2003).

Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
VAR00025	.852						
VAR00010	.800						
VAR00016	.781						
VAR00011	.741						
VAR00009	.719						
VAR00029	.716	.414					
VAR00026	.713		-.453				
VAR00017	.711	.461					
VAR00012	.708	-.318			-.428		
VAR00015	.704	-.556					
VAR00021	.696	-.486		-.335			
VAR00027	.692	.388					
VAR00013	.673	-.530					
VAR00028	.664	.414				-.300	
VAR00014	.656	-.551					
VAR00018	.608	.303	.461				
VAR00030	.608	.600	-.316				
VAR00023	.602	-.439		-.345		.457	
VAR00024	.591	-.310					-.559
VAR00002	.578		.371	.463			
VAR00005	.552		-.500				
VAR00006	.528			.508	.351		
VAR00001	.526	.333		.305	-.453		
VAR00004	.443		.307	.401		.302	
VAR00032	.547	.661	-.348				
VAR00031	.547	.661	-.348				
VAR00022	.532	-.619		-.413			
VAR00020	.454	.439	.592		.310		
VAR00019	.507	.427	.582		.309		
VAR00003	.551			.581	-.334		
VAR00008	.546				.589		
VAR00007	.381	-.326		.488	.557		

Extraction Method: Principal Component Analysis.[a]

a. 7 components extracted.

Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
VAR00022	.936						
VAR00023	.923						
VAR00021	.863						
VAR00014	.803			.373			
VAR00015	.764			.370		.378	
VAR00013	.652			.498			
VAR00032		.924					
VAR00031		.924					
VAR00030		.899					
VAR00029		.785					
VAR00028		.658		.561			
VAR00027		.643		.610			
VAR00026	.512	.568		.301			.371
VAR00020			.924				
VAR00019			.915				
VAR00018			.638		.314		.340
VAR00017		.481	.628		.333		
VAR00012	.504			.672	.337		
VAR00016	.413			.624			.320
VAR00010	.406			.577		.465	
VAR00011	.419			.500		.369	.315
VAR00025	.434	.457		.480			.450
VAR00002					.792		
VAR00003				.357	.759		
VAR00004					.732		
VAR00001		.387		.419	.598		
VAR00009		.301	.446		.475		.310
VAR00007						.861	
VAR00006					.341	.758	
VAR00008		.436	.391			.638	
VAR00005	.351	.422	-.305			.526	
VAR00024	.334					.348	.796

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 9 iterations.

Appendix I: 12 Themes from IDA stage one

(there are 3 participants in total)

Theme	Positive aspects	Negative aspects
Communication Development	Collaborative group (3) Sense of participation (2) Challenging by peers (3) Supportive channels (2)	No society engagement (2) Ineffective communication (2) Confrontation with ideas discussion (2) Insignificant motivation (1) Uncomfortable group learning (2)
Extrinsic Improvement	Significant teacher/tutor support (3) Significant peer support (2) Extrinsic motivation (2) Reflective feedback (2) Valuable thinking or ideas (3) Supportive channels (2)	Insignificant peer support (2)
Facilitating Thinking	Society for thinking (2) Critical thinking with reflection (3) Relationship between thinking and engagement (2) Relationship between thinking and peer support (3) Relationship between thinking and tutor support (2) Supportive channels (2)	Insignificant thinking (2) Unthought posting (1)
Intrinsic Improvement	Significant accountability (2) Valuable belief (2) Personality distinction (2) Significant thinking or idea (2) Significant learning experience (3) Supportive channels (2)	Insignificant accountability (2) Limited experience (2) Nervousness of opinion (2)
Learning Administration	Benefit of online learning/environment (2) Tutor-supported activities (2) Peer-supported activities (2) Supportive channels (2)	Insignificant online learning (2) Inconsistent online interaction (2)
Learning Mechanism	Ability and activity for learning (2) Valuable communication/interaction (3)	Insignificant interaction/feedback (2) Independent own learning (1)
Pedagogical Preparation	Content for participation (2) Assessment task (3) Unit introduction (2)	Insignificant task (2)
Skills Development	Understanding reflective thinking skills (2) Sense of online writing (2) Reading awareness (2) Interactive communication skills (2) Supportive channels (2)	Ineffective reflective thinking skills (2) Difficulty of writing in discussion board (2)
Student Experience	Available preparation (2) Availability of engagement (3) Opinions presentation (2)	Unsatisfied assessment grades (2)
Teaching Condition	Accountability of teacher/tutor (2) Challenging for online teaching and learning (2) Collaborative and supportive expectation (2)	Disappointed technology (2) Insignificant tutor support (2)
Technology Affordances	Availability of technology (3) Technology with IT support team (2) Online collaboration (2) Supportive channels (2)	Insignificant technology (2) Ineffective IT support (2)
Virtual Implementation	Face-to-face interactive online tutorial (2) Thinking for virtual tutorial (2) Supportive channels (2)	Insignificant virtual tutorial (2)

(*Note:* The number of the respondents for each of the sub-themes has been added in parentheses.)

Appendix J: 13 Themes from FGDA stage one

(there are 3 participants in total)

Theme	Positive aspects	Negative aspects
Communication Development	• Collaborative group *(2)* • Sense of participation *(2)* • Challenging by peers *(2)* • *Discussion for communication (2)*	• Ineffective communication *(2)* • Insignificant motivation *(2)* • Uncomfortable group learning *(2)* • *Insignificant participation (2)*
Extrinsic Improvement	• Significant peer support *(2)* • Extrinsic motivation *(2)* • Reflective feedback *(2)* • Supportive channels *(2)*	• Insignificant peer support *(2)* • *Insignificant teacher support (2)*
Facilitating Thinking	• Critical thinking with reflection *(2)* • Relationship between thinking and peer support *(2)* • Relationship between thinking and tutor support *(2)* • Supportive channels *(2)* • *Thinking for assignment (2)*	• *Obstacle of thinking (2)*
Intrinsic Improvement	• Significant accountability *(2)* • Personality distinction *(2)* • Significant thinking or idea *(2)* • Supportive channels *(2)* • *Valuable reflection (2)* • *Challenging by assignment (2)*	• Limited experience *(2)* • Nervousness of opinion *(2)* • *Stressful aspects (2)*
Learning Administration	• Tutor-supported activities *(2)* • Peer-supported activities *(2)* • Supportive channels *(2)*	• Insignificant online learning *(2)* • Inconsistent online interaction *(2)*
Learning Mechanism	• Ability and activity for learning *(2)* • Valuable communication/interaction *(2)*	• Insignificant interaction/feedback *(2)* • Independent own learning *(2)*
Pedagogical Preparation	• Unit introduction *(2)*	• Insignificant task *(2)*
Skills Development	• Understanding reflective thinking skills *(2)* • Sense of online writing *(2)* • Supportive channels *(2)* • *Questioning (2)*	• Difficulty of writing in discussion board *(2)* • *Difficulty for virtual communication (2)*
Student Experience	• Available preparation *(2)* • *Relevance for assumption (2)* • *Learning from peers (2)* • *Previous own experience (2)*	• Unsatisfied assessment grades *(2)* • *Unfamiliar answering and asking question (2)*
Teaching Condition	• Accountability of teacher/tutor *(2)* • Challenging for online teaching and learning *(2)* • Collaborative and supportive expectation *(2)* • *Clear expectation (2)* • *Modes of communication (2)*	• Disappointed technology *(2)* • Insignificant tutor support *(2)*
Technology Affordances	• Availability of technology *(2)* • Technology with IT support team *(2)* • Online collaboration *(2)* • Supportive channels *(2)*	• Insignificant technology *(2)*
Virtual Implementation	• Face-to-face interactive online tutorial *(2)* • Supportive channels *(2)*	• Insignificant virtual tutorial *(2)*
Student Demography	• ***Background** (2)* • ***Employment** (2)*	• ***Unfamiliar online learning** (2)*

(*Note:* The number of the respondents for each of the sub-themes has been added in parentheses.)

Appendix K: 15 Themes from IDA stage two

(there are 7 participants in total)

Theme	Positive aspects	Negative aspects
Communication Development	• Collaborative group (3) • Challenging by peers (3) • Supportive channels (3) • *Supportive participation* (4)	• Ineffective communication (3) • Insignificant motivation *(2)* • Uncomfortable group learning *(2)* • *Insignificant reflection (2)*
Extrinsic Improvement	• Significant teacher/tutor support (3) • Significant peer support (3) • Extrinsic motivation (3) • Supportive channels (3) • *Engagement awareness* (3)	• Insignificant peer support *(2)*
Facilitating Thinking	• Critical thinking with reflection (4) • Relationship between thinking and engagement (3) • Supportive channels (3) • *Thinking demonstration and development* (3) • *Activity for sharing of thinking* (3)	• Insignificant thinking *(2)* • *Impact of personal thinking (2)*
Intrinsic Improvement	• Significant accountability (3) • Personality distinction (3) • Supportive channels (3) • *Interactive discussion and engagement* (3)	• Stressful aspects *(2)* • *Insignificant creativity (2)*
Learning Administration	• Tutor-supported activities (3) • Peer-supported activities (3) • *Significant forum* (3)	• Insignificant online learning *(2)*
Learning Mechanism	• Ability and activity for learning (3) • Valuable communication/interaction (4)	• Insignificant interaction/feedback *(2)*
Pedagogical Preparation	• Assessment task (3) • Unit introduction (3) • *Opportunity for online learning* (3)	• Insignificant task *(2)* • *Insignificant group working (2)*
Skills Development	• Reading awareness (3) • Interactive communication skills (3) • Supportive channels (3) • Questioning (3)	• Ineffective reflective thinking skills *(2)*
Student Experience	• Availability of engagement (3) • Opinions presentation (3)	• Unsatisfied assessment grades *(2)*
Teaching Condition	• Accountability of teacher/tutor (3) • Collaborative and supportive expectation (3)	• Insignificant tutor support *(2)*
Technology Affordances	• Availability of technology (3) • Technology with IT support team (3) • Online collaboration (3) • Supportive channels (3)	• Insignificant technology *(2)* • Ineffective IT support *(2)*
Virtual Implementation	• Face-to-face interactive online tutorial (3) • Supportive channels (3)	• Insignificant virtual tutorial *(2)*
Student Demography	• Background (3) • Employment (3) • *Education* (3)	• Unfamiliar online learning *(2)* • *Not only studying (2)* • *Isolation (2)*
Learning Environment	• ***Environment for online learning*** (3)	-
Orientation to Learning	• ***Understanding the organization of unit*** (3) • ***Supportive channel*** (3)	• ***Not complete understanding for online studying*** *(2)*

(*Note:* The number of the respondents for each of the sub-themes has been added in parentheses.)

Appendix L: 14 Themes from FGDA stage two

(there are 2 participants in total)

Theme	Positive aspects	Negative aspects
Communication Development	• Collaborative group *(2)* • Discussion for communication *(2)*	• Uncomfortable group learning *(2)* • Insignificant participation *(2)*
Extrinsic Improvement	• Significant peer support *(2)* • Reflective feedback *(2)* • Supportive channels *(1)*	• Insignificant peer support *(2)* • Insignificant teacher support *(2)*
Facilitating Thinking	• Critical thinking with reflection *(2)* • Relationship between thinking and peer support *(2)* • Relationship between thinking and tutor support *(2)*	• Obstacle of thinking *(2)* • Unthought posting *(1)*
Intrinsic Improvement	• Significant accountability *(2)* • Personality distinction *(2)* • Challenging by assignment *(2)*	• Stressful aspects *(2)*
Learning Administration	• Tutor-supported activities *(2)* • Peer-supported activities *(2)* • Supportive channels *(1)*	• Insignificant online learning *(2)* • Inconsistent online interaction *(2)*
Learning Mechanism	• Ability and activity for learning *(2)* • Valuable communication/interaction *(2)*	• Insignificant interaction/feedback *(2)* • Independent own learning *(2)*
Pedagogical Preparation	• Unit introduction *(2)*	• Insignificant task *(1)*
Skills Development	• Understanding reflective thinking skills *(2)* • Sense of online writing *(2)* • Questioning *(2)*	• Difficulty of writing in discussion board *(2)*
Student Experience	• Learning from peers *(2)* • Previous own experience *(2)*	• Unfamiliar answering and asking question *(1)*
Teaching Condition	• Accountability of teacher/tutor *(2)* • Collaborative and supportive expectation *(2)* • Modes of communication *(2)*	• Disappointed technology *(1)* • Insignificant tutor support *(2)*
Technology Affordances	• Availability of technology *(2)* • Online collaboration *(2)* • Supportive channels *(1)*	• Insignificant technology *(2)*
Virtual Implementation	• Face-to-face interactive online tutorial *(2)* • Supportive channels *(2)*	• Insignificant virtual tutorial *(2)*
Learning Environment	• *Environment for critical reflection (2)*	• *Insignificant online learning (2)*
Orientation to Learning	• Understanding the organization of unit *(2)* • *Understanding for online learning process (2)*	• *Not understanding for online studying (1)*

(*Note:* The number of the respondents for each of the sub-themes has been added in parentheses.)

Appendix M: 19 Themes from IDA stage three

(there are 3 participants in total)

Theme	Positive aspects	Negative aspects
Community Development	• *Significant interaction (3)* • *Teacher support for communication (2)* • *Moderator for Collaborate session (2)* • *Collaborative group (2)*	• *Ineffective communication and interaction (2)*
Extrinsic Improvement	• *Significant peer support (3)* • *Supportive teaching team (2)*	• *Insignificant feedback (2)* • *Insignificant engagement (2)*
Facilitating thinking	• *Way of thinking (2)* • *Teacher support for thinking development (2)* • *Peer support for thinking development (2)*	• *Obstacle of thinking (2)*
Intrinsic Improvement	• *Individual characteristics (3)* • *Professional practice development (2)*	• *Without understanding of practice (2)*
Learning Administration	• Tutor-supported activities *(2)* • Peer-supported activities *(2)* • Supportive channels *(2)*	• Insignificant online learning *(2)*
Learning Mechanism	• Ability and activity for learning *(2)* • Valuable communication/interaction *(3)*	• Insignificant interaction/feedback *(2)* • Independent own learning *(2)*
Pedagogical Preparation	• Unit introduction *(3)*	• Insignificant task *(2)*
Skills Development	• *Reading and writing (2)* • *Questioning for communication (2)*	-
Student Experience	• *Opportunity of peer learning (2)* • *The relevance of learning activities (2)* • *Collaboration for learning experience (3)* • *Visual online learning (2)*	-
Teaching Condition	• *Role of teaching team (2)* • *Working with students (2)* • *Expectation for students' learning (3)*	-
Technology Affordances	• *Asynchronous technology (2)* • *Synchronous technology (2))* • *Appropriate technology (3)* • *Technology for peer learning (2)* • *Teacher support for technology affordances (2)*	• *Insignificant using technology (2)*
Virtual Implementation	• Face-to-face interactive online tutorial *(2)* • Thinking for virtual tutorial *(2)* • Supportive channels *(2)*	• Insignificant virtual tutorial *(2)*
Learning Environment	• Environment for critical reflection *(2)*	• Insignificant online learning *(2)*
Orientation to Learning	• Understanding the organization of unit *(2)* • Understanding for online learning process *(2)* • *Introduction by teaching team (3)* • *Tutorial sessions (2)*	• Not understanding for online studying *(2)*
Student Demography	• Education *(2)*	• Isolation *(2)*
Content Engagement	• ***Online participation*** *(2)* • ***Understanding about content*** *(2)*	• ***No engagement with content*** *(2)*
Human Relationship	• ***Online relationship*** *(2)* • ***Reflective thinking for relationship*** *(2)* • ***Supportive channel*** *(2)*	**-**
Moral Awareness	• ***Peers agreement and disagreement*** *(2)* • ***Comment for justification*** *(2)* • ***Moral commitment for professional practices*** *(2)* • ***Teacher support for moral awareness*** *(2)*	• ***Scare of judgement*** *(2)*
Time Management	• ***Balance of time*** *(3)* • ***Time for peers interaction*** *(3)* • ***Time for virtual Collaborate sessions*** *(2)* • ***Time for discussion board*** *(2)*	• ***Insignificant reading time*** *(2)*

(*Note:* The number of the respondents for each of the sub-themes has been added in parentheses.)

Appendix N: 22 Themes from FGDA stage three

(there are 2 participants in total)

Theme	Positive aspects	Negative aspects
Community Development	• Significant interaction *(2)* • Teacher support for communication *(2)* • Moderator for Collaborate session *(1)* • Collaborative group *(2)*	• Ineffective communication and interaction *(2)*
Extrinsic Improvement	• Significant peer support *(2)* • Supportive teaching team *(2)*	• Insignificant feedback *(2)* • Insignificant engagement *(1)*
Facilitating thinking	• Way of thinking *(1)* • Teacher support for thinking development *(2)* • Peer support for thinking development *(2)*	• Obstacle of thinking *(2)*
Intrinsic Improvement	• Individual characteristics *(2)* • *Encouragement for participation (2)*	• Without understanding of practice *(2)*
Learning Administration	• Tutor-supported activities *(2)* • Peer-supported activities *(2)* • Supportive channels *(2)*	• Insignificant online learning *(1)*
Learning Mechanism	• Ability and activity for learning *(2)* • Valuable communication/interaction *(2)*	• Insignificant interaction/feedback *(2)* • Independent own learning *(1)*
Pedagogical Preparation	• Unit introduction *(2)*	• Insignificant task *(1)*
Skills Development	• Questioning for communication *(2)* • *Reading and writing (2)*	-
Student Experience	• Opportunity of peer learning *(2)* • *Group of students (2)*	-
Teaching Condition	• Role of teaching team *(2)* • Expectation for students' learning *(2)*	-
Technology Affordances	• Asynchronous technology *(2)* • Synchronous technology *(1)* • Appropriate technology *(2)* • Technology for peer learning *(2)*	• Insignificant using technology *(2)*
Virtual Implementation	• Face-to-face interactive online tutorial *(2)* • Thinking for virtual tutorial *(2)*	• Insignificant virtual tutorial *(2)*
Learning Environment	• Environment for critical reflection *(2)*	• Insignificant online learning *(2)*
Orientation to Learning	• Understanding the organization of unit *(2)* • Understanding for online learning process *(2)* • *Significant instruction (2)*	• Not understanding for online studying *(1)*
Student Demography	• Education *(2)*	• Isolation *(2)*
Content Engagement	• Understanding about content *(2)*	• No engagement with content *(1)*
Human Relationship	• Online relationship *(2)* • Reflective thinking for relationship *(2)*	-
Moral Awareness	• Peers agreement and disagreement *(2)* • Comment for justification *(2)*	• Scare of judgement *(2)*
Time Management	• Balance of time *(2)* • Time for virtual Collaborate sessions *(2)* • Time for discussion board *(2)*	-
Assessment Driven	• ***Assessment task*** *(2)* • ***Peer interaction*** *(2)* • ***Posting*** *(2)* • ***Verbal communication*** *(2)*	• ***Responding by assignments*** *(1)*
Conversations	• ***Meaningful conversation*** *(2)* • ***Being moderator*** *(2)* • ***Engagement for conversation*** *(2)*	• ***Unnatural conversation*** *(2)* • ***Difficulty for conversation*** *(2)*
Technology Integration	• ***Notification of discussion board*** *(2)* • ***Technology-supported peer learning*** *(2)*	**-**

(*Note:* The number of the respondents for each of the sub-themes has been added in parentheses.

Appendix O: Themes list (22 themes) from Qualitative Data Analysis

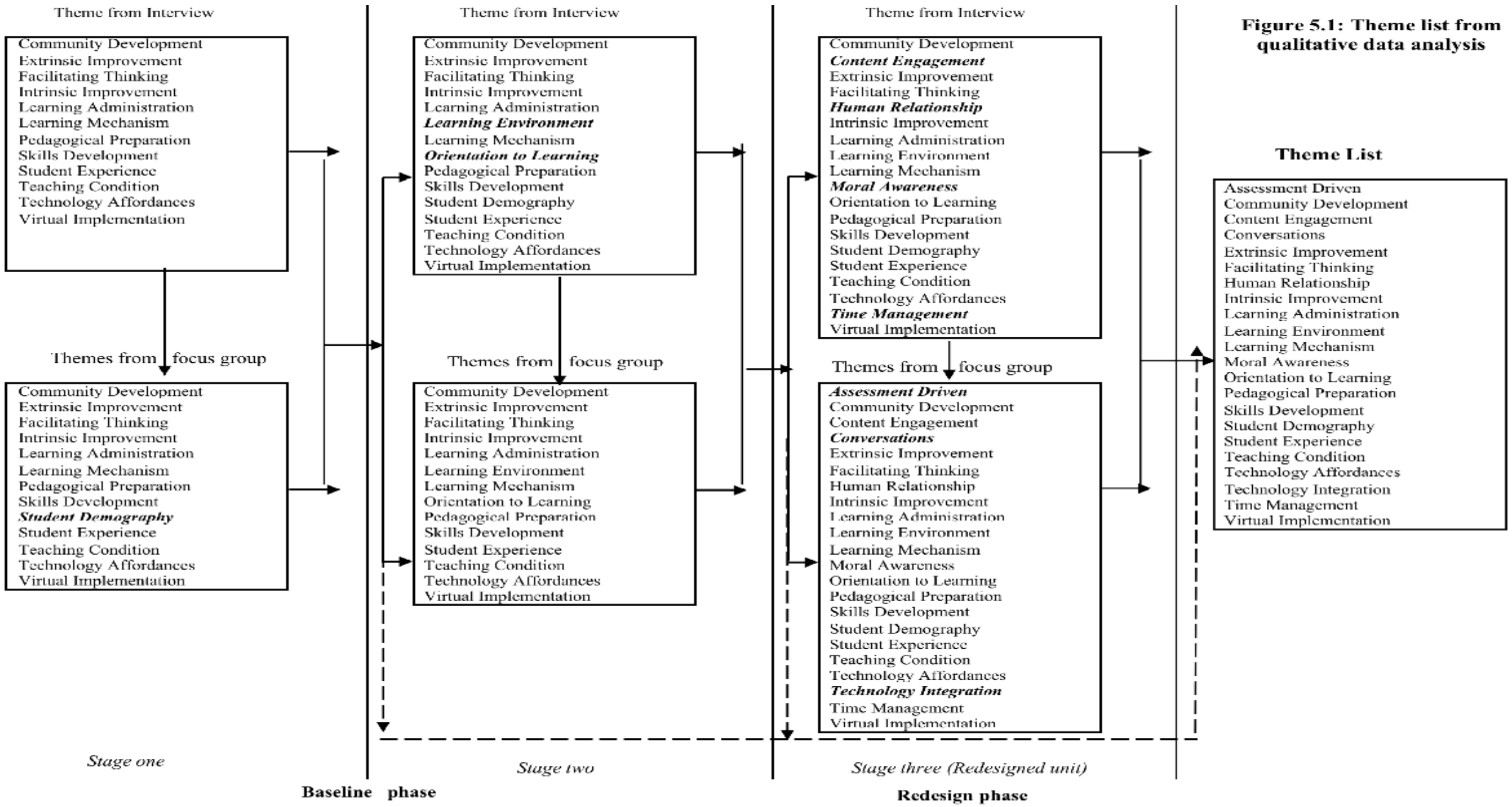


Figure 5.1: Theme list from qualitative data analysis

Appendix P: Recommendation for redesigned unit with Orientation

Demonstration for Orientation